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TRANSACTIONS

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DESCRIPTIONS OF NEW NORTH AMERICAN ANTHOMYIIDAE BELONGING TO THE GENUS PEGOMYIA ROB.-DESV.

(DIPTERA)

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(Plates I to III)

The following descriptions of new species of the genus *Pegomyia* Rob.-Desv. occurring in North America are now presented in order to facilitate the preparation of a revisional study of this group. I wish to express my indebtedness to all those who have made such a study possible by the loan of material from their collections.

Pegomyia carduorum new species

This species and the six following may be regarded as allied to *hyoscyami* Panzer. The male and female of *carduorum* may be distinguished from those of *hyoscyami* by the yellowish tinge on scutellum and to calyptrae, and further in the male by the absence of a bristle on anterodorsal surface of mid tibia.

Male, head with cheeks largely reddish, second antennal segment reddish, third segment entirely blackish, palpi yellowish brown on proximal half, fuscous apicad, occiput grayish, proboscis slender, slightly pruinescent; mesonotum cinereous gray, with dark reflections, viewed from behind with a dorsocentral mark, scutellum with a dark streak across base and tinged with reddish on ventral surface and apicad; abdomen with dense yellowish or pale brown pruinescence, and with narrow brownish dorsocentral vitta, hypopygium and fifth sternum reddish yellow; coxae largely fuscous, fore femur infuscated along dorsum and yellowish on ventral region, mid and hind femora and all tibiae yellowish, tarsi blackish; wings yellowish, increasingly so basad, calyptrae distinctly yellowish, halteres yellow.

Frons at narrowest nearly as wide as distance between posterior ocelli inclusive, frontal vitta continuous to ocellar callosity, parafrontals and parafacials and cheeks broadly developed, the latter two respectively as wide as breadth of third antennal segment, parafrontals with six or seven pairs of fine bristles, occiput moderately swollen on ventral region, third antennal segment 1.5 times as long as broad, arista subnude; thorax with presutural acrostical bristles weakly developed, in two closely adjacent series, prealar bristle short, posthumeral bristle duplicated, sternopleurals arranged 1:2; abdomen depressed, slightly narrowed and thickened caudad, sides subparallel, cerci (upper forceps) bifid at apex, dististyli (inferior forceps) blackish at apex and divided into an inner curved digitlike projection and a shorter outer extension, processes broadly developed, truncate, inner margin sinuate, apical region bare and shining, proximal region with numerous slender setulae and bristles.

Fore tibia with no anterodorsal bristle, one posteroventral bristle, apical posterodorsal absent, mid femur with six or seven bristles on proximal half of posteroventral surface, mid tibia with no anterodorsal bristle, one posterodorsal and two or three posterior bristles, hind femur with six to eight anteroventral bristles, and an irregular series of bristles on posteroventral surface, with two preapical bristles on posterior surface, hind tibia with two anteroventral, four to six anterodorsal, two or three posterodorsal, apical posterodorsal not strongly developed; wings with costal setulae and thorns inconspicuous, weakly developed, *m-cu* cross vein slightly sinuate, calyptrae subequal.

Female similar to male, frontal vitta reddish purple throughout, face whitish gray, palpi in allotype entirely reddish yellow, mesonotum with no markings, scutellum yellowish tinged, abdomen including ovipositor reddish yellow, frontal vitta with no cruciate bristles, caudal pair of ocellar bristles short and directed cephalad, ventral bristle of caudal pair of sternopleurals short, scarcely longer than prealar bristle, marginal bristles on abdominal tergum 5 weakly developed, mid femur with three or four bristles on proximal half of posteroventral surface, mid tibia with a strong anterodorsal bristle, posterodorsal bristle much shorter than anterodorsal bristle, hind femur with four or five widely spaced anteroventral bristles. Length, 6. mm.

Type.— ♂; Madison, Wisconsin; May 14, 1936; (Fred Snyder). [University of Wisconsin].

Allotype.— ♀; Arendtsville, Pennsylvania; July 6, 1927; (S. W. Frost). [A.N.S.P.].

Pegomyia indicta new species

The male of this species differs from that of *hyoscyami* in the structure of the processes, which are truncated apically, and in the absence of a bristle on anterodorsal surface of mid tibia. In addition all the femora in the type specimen are at least partly blackish.

Male, head, thorax and abdomen grayish drab, concolorous, with dense cinereous pruinescence, face grayish, antennae blackish, second antennal segment reddish tinged throughout, proboscis and palpi missing in type. Mesonotum with trace of brownish dorsocentral vitta, abdomen with an ill-defined brownish stripe, hypopygium grayish opaque, concolorous with terga, processes yellowish and polished on inner border and on distal region, coxae largely grayish, concolorous with thorax, femora largely blackish infuscated, mid and hind pairs with distal region broadly yellowish to include preapical bristles, hind femur in addition has basal region yellowish, tibiae yellowish, tarsi blackish, wings clear, yellowish tinged proximad, veins yellow, brownish tinged distad, calyptra yellowish tinged, halteres yellow.

Frons at narrowest about equal to distance between posterior ocelli exclusive, parafrontals contiguous at middle and with five or six pairs of fine bristles, parafacials at base of antennae nearly as wide as breadth of third antennal segment, narrowed ventrad, cheeks as high as breadth of third antennal segment, well maintained caudad, with a double series of fine bristles along ventral border, antennae short, third segment about 1.5 times as long as wide, arista thickened at base and almost bare.

Mesonotum with numerous fine setulae, with four or five pairs of fine presutural acrostical bristles arranged in two approximated series, prealar bristle short, posthumeral bristle weakly duplicated, sternopleural bristles arranged 1:2, ventral bristle of caudal pair scarcely as long as anterior bristle. Abdomen depressed and sides parallel, thickened caudad, terga with numerous semierect slender setulae and marginal bristles, processes broadly laminate and truncated, approximating basad, with a few short slender bristles on proximal half, inner margin sinuate.

Fore tibia with one posteroventral bristle, and with no anterodorsal bristle, apical posterodorsal setulose, mid femur with a series of six or seven fine bristles on proximal half of posteroventral surface, mid tibia with no anterodorsal, one posterodorsal and two short posterior bristles, hind femur with seven or eight anteroventral and posteroventral bristles respectively, which become much finer proximad, hind tibia with two anteroventral, five or six anterodorsal, two posterodorsal bristles, apical posterodorsal setulose; wings with costal thorns inconspicuous, *m-cu* cross vein slightly sinuate, erect, calyptrae subequal. Length, 5.5 mm.

Type.—♂; Katmai, Alaska; June 10, 1919; (J. S. Hine). [Ohio State University].

Pegomyia atlanis new species

This species may be readily distinguished from allied forms by the uniformly dark color of antennal segments, femora and palpi, and by the stripe on mesonotum. The processes of the male are structurally similar to those of *ruficeps* Stein.

Male, head, thorax and abdomen blackish with cinereous pruinescence, parafacials and parafrontals blackish with velvety pruinescence, antennae and palpi blackish, proboscis pruinescent, mesonotum and scutellum with dark reflections, subshining, the former with a brownish dorsocentral vitta and two sublateral fuscous streaks when viewed from behind, abdomen with a fuscous dorsocentral vitta, hypopygium pruinescent, processes blackish and subshining, with a glossy chitinous strip along inner margin, all femora entirely blackish except at apex, tibiae yellow, tarsi black, wings faintly yellowish tinged, calyptrae whitish, halteres yellow.

Head with parafacials and cheeks broadly developed, the former receding slightly ventrad, frons at narrowest nearly equal to distance between posterior ocelli exclusive, parafrontals contiguous at middle, cheeks as high and parafacials at base of antennae nearly as wide as breadth of third antennal segment, cheeks well maintained caudad, ventral region of occiput swollen, third antennal segment nearly twice as long as second segment, arista minutely pubescent, distal section of proboscis short and fleshy

Mesonotum with three pairs of presutural acrostical bristles in two closely adjacent series, prealar bristle short, posthumeral bristle weakly duplicated, sternopleural bristles arranged 2:3, ventral bristle of caudal pair weak. Abdomen depressed, slightly narrower and thicker caudad, dorsocentral vitta composed of a series of slender subtriangular marks, processes as in *ruficeps*, with a polished chitinous strip on inner margin and sharply tapering on distal half, inner margin with a sparse series of setulae near apex, anal sclerite with a few short bristles.

Fore tibia with no anterodorsal and with one or two posteroventral bristles, apical posterodorsal setulose, mid femur with four bristles on proximal half of posteroventral surface, mid tibia with one short anterodorsal, one posterodorsal and three posterior bristles, hind femur with seven anteroventral bristles and with five bristles on proximal two-thirds of posteroventral surface, preapical posteroventral bristle stoutly developed, hind tibia with one anteroventral, three anterodorsal and two posterodorsal bristles, apical posterodorsal bristle weakly developed; wings with costal setulae weakly developed, *m-cu* cross vein erect and straight, M_{1+2} inconspicuously curved forward at apex, calyptrae equal, claws and pulvilli stoutly developed.

Female similar to male, frontal vitta reddish, purplish caudad, second antennal segment broadly reddish along distal margin, cheeks with rufous reflections, abdominal vitta nearly uniformly linear, wings clear, ovipositor concolorous with abdomen. Cruciate bristles weakly developed, abdominal bristles short but well developed, fore tibia with an anterodorsal bristle, mid and hind femora with fewer bristles on antero- and posteroventral surfaces, mid tibia with a robust anterodorsal and posterodorsal bristle and with two shorter posterior bristles. Length, 5.5 mm.

Type ♂ and *allotype* ♀.—Orient, Long Island, New York; June 6, 1936; (H. C. Huckett). [Acad. Nat. Sci. Phila., no. 6550.]

Pegomyia convergens new species

This species has the habitus of *ruficeps*, differing in that the third antennal segment is entirely black, and palpi are broadly infuscated distad. In the female cruciate bristles are present. All the femora of the type specimens are blackish.

Male similar in color to *ruficeps* Stein, grayish drab, second antennal segment entirely yellow, third segment entirely black, face grayish, palpi pale brownish, infuscated apicad, proboscis pruinescent. Mesonotum not vittate, macrochaetae set in brownish spots. Abdomen with a fuscous dorsocentral mark, processes grayish drab, inner margin with a polished chitinous thickening distad. Fore, mid and hind femora entirely blackish, the latter two slightly paler than fore femora, tibiae yellowish, tarsi black, wings clear, calyptrae whitish, halteres yellow.

Head as in *ruficeps*, frons, parafacials and cheeks strongly developed, cheeks as high as length of third antennal segment and extending caudoventrad, oral margin of face contracted, vibrissae closer to one another than to nearest point on eye margin, frons at narrowest as wide as distance between posterior ocelli, frontal vitta uninterrupted caudad, third antennal segment slightly longer than second segment, arista bare and thickened at base

Mesonotum with four or five pairs of weak presutural acrostical bristles, series closely adjacent one another, prealar bristle short, sternopleural bristles arranged 1:2; abdomen short, and slightly depressed. processes short and slender throughout distal half, inner margin with a series of longish setulae on proximal half and with a polished strip on distal half.

Fore tibia with no anterodorsal and with one posteroventral bristle, apical posterodorsal bristle setulose, mid femur with three or four short bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal, one posterodorsal and one or two posterior bristles, all short, hind femur with five stronger and five or six setulose bristles on distal and proximal halves respectively of anteroventral surface, and with two or three fine bristles on proximal two-thirds of posteroventral surface, hind tibia with one anteroventral and three anterodorsal bristles, all short, and with two longer posterodorsal bristles, apical posterodorsal bristle well developed, wings with veins R_{4+5} and M_{1+2} subparallel, *m-cu* cross vein erect and straight, costal setulae weak, calyptrae subequal.

Female paler than male, frontal vitta largely reddish, cephalic half of parafacials, parafrontals and cheeks reddish with light pruinescence, face grayish, abdomen with trace of brownish dorsocentral marking, coxae and femora more or less purplish tinged, mid and hind pairs of femora paler than fore pair, cruciate bristles present, sternopleural bristles arranged 1:2, ventral bristle of caudal pair weak, hind femur sparsely bristled on proximal half of anteroventral surface, hind tibia with two or three normal bristles on anterodorsal surface. Length, 5 mm.

Type ♂ and *allotype* ♀.—N. E. Walker, Saskatchewan; May 20, 1923. [Canadian Nat. Collection.]

Pegomyia vicaria new species

This species comes closest to *rufescens* and *ruficeps*. It may however in the male sex be readily distinguished by the blackish antennae and yellowish processes, and by the absence of prealar bristle.

Male, head with occiput grayish and concolorous with thorax, cheeks largely reddish, face pale grayish, interfrontalia reddish yellow, antennae blackish, second segment with brownish tinge, arista with blackish basal swelling, flagellum yellowish, palpi entirely brownish; thorax grayish and subshining, with trace of three mesonotal streaks when viewed from behind, macrochaetae set in brownish spots, scutellum and humeral callosities with trace of yellowish; abdomen grayish black, terga 1+2, and 3 and ventral aspect of abdomen largely clay colored, terga 4 and 5 more densely grayish black, caudal margin of terga pale, dorsocentral vitta fuscous, processes yellow, basal plate of fifth sternum blackish; coxae more or less grayish infuscated, fore femora infuscated on proximal half and broadly yellowish on distal half, tarsi yellowish to pale brownish, remainder of legs yellowish; wings clear, calyptra whitish, halteres yellow.

Frons at narrowest about as wide as distance between posterior ocelli exclusive, frontal vitta continuous to ocellar callosity, restricted to lineal dimensions caudad, parafrontals, parafacials and cheeks in profile broad and prominent, cheeks well produced caudad, ventral region of occiput swollen, third antennal segment 1.5 times length of second segment, arista minutely pubescent, almost bare; series of presutural acrostical bristles closely placed together, consisting of two or three pairs of weak bristles, prealar bristle absent, sternopleural bristles arranged 1:2, abdomen depressed, slightly tapering and thickened caudad, sides subparallel, with an interrupted uniformly broad dorsocentral vitta as in *ruficeps*, anal sclerite sparsely clothed with coarse black setulae, processes short, broad basad and sharply tapering apicad, with few fine bristles and setulae.

Fore tibiae with one posteroventral bristle, apical posterodorsal setulose, mid femur with two or three bristles on proximal half of posteroventral surface, preapical and proximal series of bristles on anterior surface not present, mid tibia with no anterodorsal bristle, with one posterodorsal and two shorter posterior bristles, hind femur with three or four widely spaced bristles on anteroventral surface and three bristles on proximal half of posteroventral surface, hind tibia with an anteroventral, two anterodorsal bristles situated on proximal half, two posterodorsal bristles, apical posterodorsal setulose; wings with costal thorn and setulae weakly developed, *m-cu* cross vein erect, sinuate at middle, calyptrae subequal. Length, 4.5 mm.

Type.—♂; Lind, Washington; Aug. 18, 1919; (F. W. Carlson). [Acad. Nat. Sci. Phila., no. 6551.]

Paratype.—♂, same locality and date as type. [A. L. Melander.]

In the paratype the fore femur is entirely yellowish and abdomen almost entirely grayish black.

Pegomyia marginata new species

This species is striking in that in the male the processes become expanded mesad as a broad lamellate extension from the inner margin; in the female the palpi are enlarged and flattened. The same type of process is to be found in the european species *strigipes* (Zett.).

Male, head black, second antennal segment yellowish along apical border, third segment entirely grayish black, palpi fuscous, proboscis brownish, shining. Thorax brownish black, mesonotum viewed from behind with trace of interserial dark stripes; abdomen dull reddish, with darker dorsocentral stripe, hypopygium blackish; wings and calyptrae uniformly brownish tinged, halteres yellow; fore coxae, fore femora and apical region of mid and hind femora fuscous tinged, tarsi brownish, otherwise legs largely yellowish.

Frons at narrowest width not equal to diameter of anterior ocellus, eyes proportionately large, parafacials at base of antennae less than half width of third antennal segment, nearly obliterated ventrad by the outline of eye margin, cheeks nearly equal to width of third antennal segment, the latter nearly twice as long as second segment, arista minutely pubescent; series of presutural acrostical bristles closer to one another than to their respective series of dorsocentral bristles, consisting of three pairs of fine bristles, prealar bristle short, posthumeral bristle duplicated, sternopleural bristles arranged 1:2, abdomen short and robust, hypopygium well developed, processes with a lamellate fold extending mesad from inner margin and with a series of slender setulae along inner margin from base to apex, outer border with a few stronger bristles basad.

Fore tibia with a posteroventral bristle, apical posterodorsal absent, mid femur with three bristles on proximal half of posteroventral surface and with three preapical bristles on posterior surface, mid tibia with one anterodorsal, one posterodorsal and two or three short posterior bristles, hind femur with four or five stronger bristles on distal half and four or five weaker shorter bristles on proximal half of anteroventral surface, proximal half of posterior and posteroventral surfaces with numerous scattered fine bristles, with two preapical bristles on posterior surface, hind tibia with two or three anteroventral bristles situated on distal half, three anterodorsal, two posterodorsal, apical posterodorsal bristle setulose; wings longish, with costal setulae and thorns weakly developed, *m-cu* cross vein erect and slightly sinuate at middle, veins M_{1+2} and R_{4+5} subparallel to wing margin, calyptrae subequal. Length, 5 mm.

Female with head and thorax densely grayish black, frontal vitta, parafacials and cheeks largely reddish, parafrontals grayish, face grayish black, second antennal segment brownish, thorax entirely blackish, mesonotum with brownish pruinescence, abdomen darker than thorax and shiny, with little if any trace of dorsocentral vitta or reddish coloration as in male; legs largely reddish brown, fore femur fuscous tinged, calyptrae more densely yellowish than in male. Antennae and palpi enlarged, broad and flattish, the former reaching a level with oral margin, the latter about as long as maximum length of eye and armed with fine sparse setulae, cruciate bristles not present, caudal pair of ocellar bristles short and directed forward, parafacial at base of antennae as wide as height of cheek, series of presutural acrostical bristles separated from one another by a distance not greater than that between respective series of acrostical and dorsocentral bristles, marginal bristles of abdominal terga weakly developed, basal sclerites of ovipositor blackish and shining, compressed laterad; fore femur with a stronger developed bristle at apex of posterior surface, mid and hind femora with no bristles on posteroventral surface, with a well developed bristle at base of ventral surface, mid tibia with bristles confined largely to distal half.

Type.—♂; Orcas Island above Mt. Lake, Washington; Aug. 18, 1925; (A. L. Melander). [A. L. Melander.]

Allotype.—♀; Newman Lake, Idaho; May 16, 1925; (A. L. Melander). [A. L. Melander.]

Paratype.—♂; Vancouver, British Columbia; August 25, 1926; (J. Stanley). [C. N. C.]

Pegomyia pertusa new species

This species may be linked to those of the *hyoscyami* group, as evidenced by the male. It possesses no striking characters that would serve to readily distinguish the species from allied forms. The palpi in the type are entirely yellow and the proboscis polished black; the eyes are closely aproximated and processes possess a series of longish setulae along the greater part of inner margin.

Male, head drab gray, parafacials and cheeks reddish, face grayish with blackish pencillings along lateral margins, second antennal segment reddish, slightly infuscated proximad, third segment entirely black, palpi entirely yellow, proboscis shining black; thorax grayish drab, with no dorsal vittae, scutellum with trace of yellowish tinge on ventral surface apicad, abdomen paler, grayish drab, with fuscous subtriangular marks along dorsocentral plane, and with broad yellowish incisures along caudal border of each tergum, hypopygium, processes and greater part of ventral surface of abdomen yellowish; fore femur with grayish black infuscation along dorsal surface, ventral half yellowish, mid and hind femora and tibiae yellowish, tarsi blackish; wings and calyptrae clear, halteres yellow.

Frons at narrowest width about equal to diameter of anterior ocellus, parafacials well developed at base of antennae, cheeks broad and well maintained caudad; third antennal segment broadly developed, slightly longer than wide, arista minutely pubescent, slightly thickened basad, palpi slender, series of presutural acrostical bristles well separated from one another, prealar bristle short, posthumeral bristle duplicated, sternopleural bristles arranged 1:2, with one or two weak bristles ventrad; abdomen depressed, sides subparrallel, slightly thickened caudad, processes clothed with a dense series of longish setulae along proximal two-thirds of inner border, apical region bare and tapering, inferior forceps short and rounded, deeply incised throughout apical region.

Fore tibia with a posteroventral bristle, mid femur with two or three strong bristles on proximal half of posteroventral surface, mid tibia with one antero- and one posterodorsal bristle, two or three short posterior bristles, hind femur with seven or eight anteroventral bristles, a bristle at middle of posteroventral surface, hind tibia with one anteroventral, four or five short anterodorsal, two posterodorsal bristles, apical posterodorsal weakly developed; wings with costal setulae and thorns weakly developed, veins R_{4+5} and M_{1+2} sharply divergent at wing margin. Length, 5.5 mm.

Type.— ♂ ;Edmonton, Alberta; May 8, 1937; (F. O. Morrison). [Acad. Nat. Sci. Phila., no. 6552.]

Pegomyia sitiens new species (Figs. 1, 10, 15.)

This species is allied to *flavifrons* (Walker) (=*fringilla* Mall.), the males of which may be distinguished by the possession of interserial markings on mesonotum. Structurally *sitiens* closely resembles the european species *esuriens* (Meigen), from which it differs by having the abdomen and second antennal segment reddish and the palpi paler proximad.

Male, head with cheeks and parafacials more or less reddish, face pale grayish, second antennal segment reddish yellow, third segment blackish, palpi fuscous distad, reddish yellow proximad, mesonotum and scutellum blackish, viewed from behind with dense grayish pruinescence and well formed interserial markings between the series of acrostical, dorsocentral and intraalar bristles, scutellum with a brownish dorsocentral marking and dark reflective area across base; abdomen reddish with whitish pruinescence and with a series of deeper reddish subtriangular markings along dorsocentral plane, processes as in *bicolor*, bare and polished on apical region; coxae infuscated, fore femora largely infuscated on dorsal half, yellowish ventrad, tarsi dark brownish, mid and hind femora and all tibiae yellowish; wings and calyptrae clear, halteres yellow.

Frons at narrowest not wider than distance between posterior ocelli, with a pair of minute setulae adjacent anterior ocellus, with six pairs of slender bristles on cephalic half, parafacials and cheeks as wide and as high respectively as breadth of third antennal segment, cheeks well maintained caudad, third antennal segment 1.75 times as long as wide, arista subnude, series of presutural acrostical bristles closer to one another than to their respective series of dorsocentral bristles, with a few setulae between the series, prealar bristle short, posthumeral bristle duplicated, sternopleural bristles arranged 1:2, abdomen depressed and slightly narrowed caudad, sides subparallel, processes widely separated, short and rounded on apical region as in *bicolor*, with dense fine setulae and a few bristles on proximal half, inner margin between the processes developed into a chitinous fold.

Fore tibia with a posteroventral bristle, mid femur with one or two bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal, one posterodorsal and two short posterior bristles, hind femur with six anteroventral bristles which are continued in series to near base, and with two or three bristles on proximal half of posteroventral surface, hind tibia with one anteroventral, three to five anterodorsal, two or three posterodorsal bristles, apical posterodorsal finely developed; wings pointed, costal setulae and thorns fine and inconspicuous, *m-cu* cross vein straight, calyptrae subequal.

Female similar to male, frontal vitta reddish throughout, cruciate bristles absent, caudal pair of ocellar bristles short, directed forward, parafacials and cheeks at maximum width and height respectively scarcely equal to breadth of third antennal segment, mesonotum with interserial markings more obscurely developed than in male, ventral bristle of caudal pair of sternopleurals short, ovipositor reddish yellow, short and sparsely bristled as in *hyoscyami*, legs with coxae and fore femora more yellowish, fore and mid tibiae with stronger anterodorsal bristle. Length, 5.5 mm.

Type.—♂; Lethbridge, Alberta; June 6, 1923; (H. L. Seamans). [Can. Nat. Colln.]

Allotype.—♀; Banff, Alberta; July 16, 1922; (C. B. D. Garrett). [C. N. C.]

Paratypes.—♂; Edmonton, Alberta, May 15, 1937; (F. O. Morrison). [A.N.S.P.] 1 ♂; Watertown, Connecticut; June 5, 1931. 1 ♀; Yellowstone Canyon, Wyoming; July 12, 1922. 1 ♀; Yellowstone Park, Clematis Creek, Wyoming; July 9, 1923; (A. L. Melander). [A.L.M.]

Pegomyia variegata new species

This species may be grouped with *bicolor* (Wied.) and allied forms on the strength of many common structural characters, notably in the form of the processes in male. In addition the hind tibiae possess a robust apical posterodorsal bristle. Specimens of *variegata* may however be distinguished from known forms by the color of the abdomen and palpi, and by the presence of cruciate bristles in female.

Male, head with occiput pale grayish drab, face pale, whitish, second antennal segment and basal region of third antennal segment yellowish, arista yellowish to brownish, palpi fuscous, paler proximad; thorax grayish black, mesonotum subshining and with no distinctive vittae, humeral callosities and scutellum with or without trace of yellowish tinge; abdomen clay colored and with grayish drab pruinescence, becoming denser on each successive segment caudad, with pale incisures along caudal margin of terga, with fuscous dorsocentral vitta, processes brownish and with distal half shining; coxae, femora and tibiae yellowish, or the coxae and fore femora may be more or less infuscated, tarsi brownish, wings and calyptrae clear, halteres yellow.

Frons at narrowest about equal to distance between posterior ocelli exclusive, parafrontals with a pair of minute setulae adjacent anterior ocellus, parafacials at base of antennae slightly narrower than breadth of third antennal segment, cheeks well maintained caudad, in height fully equal to width of third antennal segment, the latter short and about 1.5 times as long as broad, arista distinctly short pubescent; mesonotum with presutural acrostical bristles in two closely adjacent series, each composed of three or four bristles, prealar bristle short, sternopleural bristles arranged 1:2, abdomen depressed, slightly narrower caudad, and with sides parallel, marginal bristles stoutly developed on dorsum, processes widely separated at base, extended as narrow slender lamellae throughout distal half, truncated at apex, largely devoid of setulae and bristles, broadened basad and armed with a series of slender setulae along inner border, inner margin with a chitinous fold across the basal region between the processes.

Fore tibiae with an anterodorsal and posteroventral bristle, apical posterodorsal moderately well developed, mid femur with one or two bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal and posterodorsal bristle, two posterior bristles, hind femur with five anteroventral bristles on distal two-thirds of surface, with two or more diverse bristles on posteroventral surface, hind tibia with one anteroventral, three or four anterodorsal, two or three posterodorsal bristles, apical posterodorsal well developed. Wings with costal thorn and setulae weakly developed, *m-cu* cross vein slightly sinuate, veins M_{1+2} and R_{4+5} slightly divergent toward wing margin.

Female similar to male, third antennal segment more yellowish tinged and palpi paler, brownish apicad, proboscis brownish, frontal vitta deep reddish throughout, humeral callosities and scutellum largely yellowish testaceous, cruciate bristles present, marginal bristles on terga 3, 4 and 5 stoutly developed, ventral bristle of caudal pair of sternopleurals short, less than half length of dorsal bristle, chaetotaxy of legs similar to that of male. Length, 5 75 mm.

Type.—♂; College Park, Maryland; September 7, 1912; (mining *Chenopodium ambrosioides*). [U. S. Nat. Mus.]

Allotype.—♀; same locality as type; September 2, 1912. [U. S. N. M.]

Pegomyia pollinosa Ringdahl (Figs. 2, 8, 16.)

Pegomyia (Pegomyia) pollinosa Ringdahl, Entomol. Tidskr, LIX, p. 209, 1938.

The species runs in the keys of european authors to *flavoscutellata* Zett., but according to Ringdahl it is doubtful whether that species is here represented. Ringdahl informs me that he has also taken the species at Hälsingborg, Sweden. Structurally the species resembles *flavipalpis* Zetterstedt, specimens of which I have seen from North America. The male may be distinguished by the coloration of the thorax; and in the female the fore femur has no strongly developed preapical bristle on posterior surface, the ovipositor is strongly chitinised and appressed, and hind tibia has three anterodorsal bristles.

ALBERTA: ♂, Wabamun, July 1, 1931, (E. H. Strickland), [C.N.C].
ONTARIO: ♂, Ottawa, June 18, 1916, (W. T. M. Forbes), [A.N.S.P.].
NEW YORK: ♀, Cranberry Lake, July 21, 1920, [C.N.C.].

Pegomyia corrupta new species

This is the species recorded by Malloch[1] as probably *albimargo* (Pand.) from Nome, Alaska. I regard the specimens as distinct from that species owing to the absence of interserial markings on mesonotum.

Male, head and thorax blackish, antennae largely blackish, second segment with trace of reddish along distal margin, palpi largely fuscous, paler basad, proboscis polished, thorax without vittae, grayish pruinescent, scutellum reddish tinged apicad, abdomen dull reddish or reddish brown, with narrow black incisures across caudal margin of terga 1+2, 3 and 4, all coxae and femora brownish black, tibiae yellowish, tarsi fuscous, wings brownish tinged throughout, calyptrae tinged, halteres yellow.

Eyes high, restricting the cheeks and parafrontals, frons at narrowest not as wide as diameter of anterior ocellus, parafrontals with three or four pairs of slender bristles, cruciate setulae present, cheeks sharply curtailed caudad by advanced position of postgenal margin, parafacials at widest slightly greater than half breadth of third antennal segment, the latter reaches ventrad to a level with oral margin.

Thorax with three pairs of presutural acrostical bristles, prealar bristle short, posthumeral bristle duplicated, sternopleural bristles arranged 3:3, ventral bristles weak; abdomen depressed and with sides parallel, slightly thickened caudad, bristles slender, processes short and truncate, shining along inner border and apical margin, inner margin with a series of fine setulae, apical region bare.

Fore tibia with weak anterodorsal, posteroventral bristle present, apical posterodorsal bristle setulose, mid femur with three bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal, one posterior, and one posteroventral bristle, all short, and with one stronger posterodorsal bristle, hind femur with five or six anteroventral bristles and with one or two bristles on proximal half of posteroventral surface, hind tibia with one anteroventral, two anterodorsal and two posterodorsal bristles, apical posterodorsal bristle setulose, pulvilli elongate, wings with *m-cu* cross veins erect, slightly sinuate, costal setulae inconspicuous. Length, 5 mm.

Type.—♂; Nome, Alaska; Aug. 24-25, 1916; F. Johansen). [Can. Nat. Coll.]

Paratypes.—2 ♂; Nome, Alaska; Aug. 21, 1916; (F. Johansen). [C. N. C.]

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[1] Malloch, J. R. 1919. The Diptera collected by the Canadian Expedition, 1913-1918 (excluding the Tipulidae and Culicidae). *Rept. Can. Arctic Exped.*, 1913-18, III, Ins., pt. C., p. 74C.

Pegomyia longicornis new species

This species may be distinguished readily by the structure of the head and the long antennae. Except for the tibiae and apical region of femora the species is blackish in color. Another closely allied form is described herewith. It may be distinguished from *longicornis* through differences in structure and bristling of processes of fifth abdominal sternum in male.

Male entirely blackish except at apex of femora and all tibiae, which are reddish brown, calyptrae, wings and pulvilli faintly brownish tinged, halteres yellow, proboscis polished; mesonotum deep black from in front and with dense brownish pruinescence when viewed from behind, scutellum with trace of darker marking across cephalic border, apical region subshining, abdomen subshining but with dense brownish pruinescence when viewed from behind, with slender subtriangular tergal markings, hypopygium blackish and subshining.

Eyes large, restricting parafrontals, parafacials and cheeks to lineal dimensions, frons at narrowest not wider than diameter of anterior ocellus, parafacials at base of antennae about half as wide as breadth of third antennal segment, cheeks slightly wider than parafacials and abruptly restricted caudad by the occipitogenal margin, parafrontals with three or four pairs of bristles, third antennal segment large and reaching a level with oral margin, in length fully three times as long as second segment, arista distinctly pubescent, palpi slender.

Thorax with three pairs of presutural acrostical bristles, the series well separated and possessing a few setulae, prealar bristle short, posthumeral bristle duplicated, sternopleural bristles arranged 1: 2; abdomen depressed and with sides parallel, slightly thickened caudad, sterna 2, 3 and 4 weakly and sparsely bristled on disc, processes tapering apicad, inner border with an inner series of dense fine hairs and an outer series of fine longish setulae extending from base to preapical region and with a few bristles proximad, outer border polished and devoid of bristles and setulae.

Fore tibia with a weak anterodorsal and a posteroventral bristle, apical posterodorsal bristle setulose, apical posteroventral bristle finely developed, mid femur with three or four short bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal and one posterodorsal bristle, with two shorter posterior bristles, hind femur with seven or eight anteroventral bristles, those on distal half much stouter developed than those proximad, and with four or five diverse bristles on proximal half of posteroventral surface, hind tibia with one anteroventral, three anterodorsal and two posterodorsal bristles, apical posterodorsal setulose; wings pointed apicad, with costal setulae fine and inconspicuous, *m-cu* cross vein slightly sinuate, calyptrae subequal. Length, 5.5 mm.

Female paler than male, head with frontal vitta blackish caudad, reddish to orange cephalad, second antennal segment reddish along distal border, mesonotum with brownish infuscation, abdomen with trace of brownish dorsocentral vitta, femora more or less fuscous, tibiae yellowish, wings and calyptrae yellowish tinged; head with cruciate bristles absent or present, abdominal bristles weakly developed, wings with setulae on under surface of costa, and with apical margin broadly rounded, mid and hind femora with one or two weak bristles on proximal half of posteroventral surface, hind femur with four bristles on distal half of anteroventral surface, proximal half bare. Length, 5 mm.

Type.—♂, Keremeos, British Columbia; June 23, 1923; (C. B. Garrett). [Can. Nat. Coll.]

Allotype.—♀; same locality as type; June 17, 1923; (C. B. Garrett). [C. N. C.]

Pegomyia aninotata new species

Male similar to that of *longicornis,* differing essentially in the structure and bristling of processes of fifth abdominal sternum. The processes are proportionately well developed, two or three times as long as average width, slightly narrowed distad, approximated basad, inner margin with a series of fine setulae which become denser and longer basad, distal region shiney, outer border (dorsal) with numerous robust bristles which become sparser and shorter distad. Abdominal vitta broader than in *longicornis* and is composed of a series of subtriangular fuscous marks. Series of presutural acrostical bristles closer to one another than in *longicornis,* distance separating them slightly less than that between the respective series of acrostical and dorsocentral bristles. Parafacials and cheeks are reddish brown, second antennal segment slightly shorter than in *longicornis.* Mid femur with bristles on proximal half of posteroventral surface longer than breadth of femur where situated.

Type.—♂; Banff, Alberta; May 29, 1917. [Can. Nat. Coll.]

Pegomyia mallochi new species

This species is the *winthemi* recorded by Malloch. The true *winthemi,* in my opinion, has been described by Malloch as *fuscofasciata.* The salient diagnostic characters of the species have been already indicated by Malloch [2] in his key to the males of the North American species of Pegomyia.

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[2] Malloch, J. R. 1920. A synopsis of the North American species of the genus Pegomyia Robineau-Desvoidy (Diptera, Anthomyiidae). *Bull. Brooklyn Ent. Soc.,* XV, No. 5, pp. 121-127.

Similar to *winthemi* (Meigen), differing in that arista is distinctly pubescent with hairs slightly longer than basal diameter of arista, palpi fuscous. Thorax with presutural series of acrostical bristles fully as widely separated from one another as distance between the respective series of acrostical and dorsocentral bristles, with a few setulae between the series of acrosticals, with no duplicating posthumeral bristle, the region where such bristle would appear if present notably bare and devoid of setulae, scutellum nearly devoid of accessory setulae on disc. Fore femur largely yellowish, hind femur with four to six bristles on proximal half of posteroventral surface, wings yellowish tinged in male.

Female with cruciate bristles absent, lower bristle of caudal pair of sternopleurals slightly longer than anterior bristle, mid and hind tarsal segments 3, 4 and 5 broadened as in *winthemi.*

Type.—♂; Riverhead, Long Island, New York; July 11, 1926. [Acad. Nat. Sci. Phila., no. 6553.]

Allotype.—♀; same locality as type; August 10, 1927. [A.N. S.P.]

I have named the species in honor of Mr. J. R. Malloch.

Pegomyia tacta new species

The species finds its closest affinities with *unguiculata* Mall. and *intersecta* (Meig.). The processes in male are horney in appearance, and are almost bare, the prebasal sclerite is clothed with numerous fine bristles. In the female the palpi are weakly bristled and narrowly spatulate. In addition, the prosternum of all the specimens of this species that I have seen possesses a pair of bristles.

Male, head blackish, frontal vitta and parafacials at base of antennae and adjoining vibrissal area reddish tinged, antennae blackish, palpi reddish, proboscis polished; thorax grayish black, subshining, viewed from behind with grayish pruinescence on mesonotum, the latter with trace of three brownish vittae, scutellum with trace of blackish mark across base and obscurely reddish tinged at apex, humeral callosities partly reddish tinged; abdomen reddish yellow, faintly pruinescent except along dorsocentral plane, with or without blackish incisures along caudal margin of terga, basal sclerite of hypopygium brownish black, shining, anal sclerite yellowish and subshining, processes yellowish; wings slightly yellowish tinged, increasingly so basad, calyptrae densely yellowish, halteres yellow; fore coxae and fore femora more or less fuscous, mid and hind coxae and femora and all tibiae yellowish, tarsi blackish.

Frons at narrowest not wider than diameter of anterior ocellus, cruciate setulae present, parafrontals with three pairs of weak bristles, parafacials and cheeks narrow, maximum breadth and height respectively slightly more than half breadth of third antennal segment, the latter nearly three times as long as second segment, arista minutely pubescent; series of presutural acrostical bristles slightly closer to one another than to their respective series of dorsocentral bristles and consisting of three pairs of bristles, posthumeral bristles duplicated, prealar bristle short, sternopleural bristles arranged 1: 3, ventral bristle weak, prosternum with a pair of bristles; abdomen depressed, margins subparallel, tapering caudad, marginal bristles well developed on terga 3 and 4, basal sclerite of hypopygium clothed with numerous fine short bristles, anal segment angular dorsad (cephalad), armed with three or four weak bristles, as in *intersecta* (Meigen), fifth sternum largely devoid of bristles, processes of horney texture and with a prominent chitinous lamellate extension from inner margin, sharply restricted at base near which there are one or two marginal bristles, apex armed with a short inner and outer series of tactile setulae.

Fore tibia with an anterodorsal and posteroventral bristle, apical posterodorsal absent, mid femur with one or two weak bristles near base of anteroventral surface and with four or five short diverse bristles on proximal half of posteroventral surface, mid tibia with one antero- and one posterodorsal bristle, three posterior bristles, hind femur with six or seven anteroventral bristles, those proximad much weaker, and one or more bristles on proximal half of posteroventral surface, hind tibia with one anteroventral, three or four anterodorsal and two posterodorsal bristles, apical posterodorsal weakly developed; wings with costal setulae and thorns weakly developed, *m-cu* cross vein erect, slightly sinute at middle. Length, 5.75 mm.

Female similar to male, frontal vitta entirely reddish, purplish caudad, second antennal segment with trace of reddish along apical margin, parafacials and cheeks reddish tinged, palpi entirely yellowish, humeral callosities reddish tinged, scutellum entirely grayish black, cruciate bristles well developed, caudal pair of ocellar bristles erect and directed outward, palpi with sparse weak setulae, narrowly spatulate, prosternum with a pair of bristles, sternopleural bristles arranged 1: 1, with a weakly developed bristle below the caudal bristle, abdominal bristles weakly developed. Length, 5.5 mm.

Type.—♂; Edmonton, Alberta; July 9, 1929; (E. H. Strickland). [Can. Nat. Coll.]

Allotype.—♀; Birtle, Manitoba; August 20, 1928; (R. D. Bird). [C. N. C.]

Paratype.—♂; Edmonton, Alberta; June 13, 1936; (E. H. Strickland). [A.N.S.P.]

Pegomyia cuticornis new species

This species and the two following may be associated with *dissecta* (Meigen) and allied forms largely owing to the typical form of the processes in male. It may also be noted that in all such species the apical setulae of scutellum are hairlike and that in the female cruciate bristles are present. The species *cuticornis* is larger than most of the forms that belong to the group possessing black tibiae, and it also may be distinguished in that *m-cu* cross vein is not so erect.

Male, head blackish, with silvery pruinescence, antennae and palpi entirely black, proboscis pruinescent, thorax grayish, subshining, viewed from behind with five mesonotal vittae, scutellum entirely black, abdomen more densely pruinescent than thorax, with a blackish dorsocentral vitta, legs entirely blackish, pulvilli brownish tinged, wings hyaline, calyptrae whitish, halteres yellow.

Eyes separated at narrowest part of frons by a distance not greater than width of anterior ocellus, parafacials and cheeks in profile as wide as three-quarters length of third antennal segment, parafrontals with a pair of fine setulae adjacent anterior ocellus, third antennal segment short and not broad, arista minutely pubescent, palpi flattish, slightly broadened distad, lower region of occiput densely setulose and slightly swollen.

Thorax with three pairs of presutural acrostical bristles, with a few setulae between the series, posthumeral bristles weakly duplicated, prealar bristle short, disc of scutellum devoid of accessory setulae, apical setulae of scutellum hairlike, sternopleural bristles 1:2, abdomen short, depressed, slightly thickened caudad, processes appressed to abdomen, widely divergent and tapering distad, with a dense fringe of hairs on inner margin and with numerous bristles at apex, hypopygium subshining.

Fore tibia with robust preapical dorsal bristle and weak apical and mid posteroventral bristles, mid femur with a weak preapical anterior bristle and with a series of short bristles on proximal two-thirds of posteroventral surface, mid tibia with a weak anterodorsal, stronger posterodorsal and two short posterior bristles, apical posteroventral bristle short, hind femur with seven to nine anteroventral bristles and with bristles on proximal two-thirds of posteroventral surface, hind tibia with an anteroventral, three anterodorsal, and two posterodorsal bristles, apical anterodorsal short and apical posterodorsal bristle setulose; tarsi with claws and pulvilli robust; wings with *m-cu* cross vein oblique and slightly sinuate, under surface of costa with setulae. Length, 5.5 mm.

Female paler than male, grayish drab with denser pruinescence, frontal vitta with a conspicuous orange to reddish patch at base of antennae, abdomen with ill-defined subtriangular dorsocentral marks on the terga, becoming linear on the fifth; cruciate bristles present, vibrissal angle rather prominent, oral margin curved cephalad, antennae small, disc of scutellum with several setulae, lower sternopleural bristle of caudal pair weakly developed, marginal bristles on terga not strongly developed, fore tibia with an anterodorsal bristle, mid tibia with a stronger anterodorsal bristle, hind femur with five or six anteroventral bristles, the series seldom extending to base, and with two or three fine short bristles on proximal third of posteroventral surface. Length, 6 mm.

Type ♂ and *allotype* ♀. — Hedley, British Columbia; July 20, 1923; (C. B. D. Garrett). [Can. Nat. Coll.]

Paratype. — ♀; Hedley, British Columbia; August 29, 1923; (C. B. D. Garrett). [A.N.S.P.]

Pegomyia rectifrons new species

This species and the following one possess the habitus of *abnormis* Stein, from which they differ essentially in the male by having the eyes closely approximated across frons.

Male, grayish black, frons reddish, second antennal segment entirely yellow, third segment reddish at base, largely grayish tinged, palpi yellow, proboscis lightly pruinescent, mesonotum with pale brownish infuscation and trace of dorsocentral vitta, humeral callosities and scutellum broadly yellowish testaceous, abdomen slightly darker shade than thorax, with fuscous dorsocentral vitta and fuscous paired marks on cephalic half of terga 3, 4 and 5, hypopygium and processes blackish, concolorous with terga, legs yellow, fore coxae and femora with trace of infuscation, tarsi fuscous, wings and calyptrae clear, halteres yellow.

Eyes large, restricting parafacials to narrow dimensions, frons linear caudad, parafrontals with a minute pair of hairs adjacent ocellar callosity and with three pairs of weak bristles on cephalic half, cruciate setulae present, ocellar and vertical bristles weakly developed, setulose, vibrissae stoutly developed, chaetataxy of thorax and abdomen as in *abnormis*, legs with similar bristling as in that species except that on fore and mid tibiae bristles are weaker, caudal surface of hind coxae with one or two hairs proximad. Length, 6.5 mm.

Type. — ♂; " Mts." Mountains, Moscow, Idaho; July 10; (R. C. Shannon). [Acad. Nat. Sci. Phila., no. 6554.]

The type specimen of *rectifrons* is, in my opinion, conspecific with the form discussed by Stein [3] at the close of his description of *abnormis*, and which I have seen.

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[3] Stein, P. 1920. Nordamerikanische Anthomyiden, 2. Beitrag. *Arch. f. Naturgesch.*, (1918), LXXXIV, A, heft 9, p. 67. May.

Pegomyia anabnormis new species

Male. Resembles *rectifrons*, differing essentially as follows: Third antennal segment entirely black, humeral callosities and scutellum entirely blackish, concolorous with mesonotum, hypopygium and processes reddish tinged. Coxae and femora uniformly and extensively infuscated, brownish, mid and hind femora slightly paler than fore femora, hind coxae with no hairs on proximal region of caudal surface. Length, 4.75 mm.

Female resembles that of *abnormis* except that thoracic pleura and abdomen are darker and tergal markings more intensively brownish, hind coxae with or without hairs on caudal surface proximad. Length, 5 mm.

Type.—♂; Keremeos, British Columbia; July 31, 1923; (C. B. D. Garrett). [Can. Nat. Coll.]

Allotype.—♀; Falls, Forest Home, San Bernardino County, California; September 4, 1934; (A. J. Basinger). [C. N. C.]

Pegomyia fumipennis new species

The male of the species is blackish in color, with the wings and calyptrae brownish tinged. In certain respects the species resembles *rubivora* (Coquillett), from which it may be distinguished in the male by the narrower frons and parafacials and by the absence of a prominent series of setae along inner margin of processes.

Male with head and appendages entirely black, proboscis polished, face grayish black; thorax deep brownish black; abdomen drab, with darker dorsocentral marks, hypopygium and processes blackish and subshining; legs black, wings densely infuscated, calyptrae and hairs brownish tinged, halteres deep yellow with purplish tinge.

Eyes large and almost contiguous at middle of frons, parafacials and cheeks not prominently wide, the latter with numerous slender upturned bristles along ventral margin, occipital setulae dense and matted, third antennal segment nearly twice as long as second segment, arista minutely pubescent, palpi not noticeably broadened distad, proboscis not fleshy. Thorax with three pairs of slender presutural acrostical bristles, situated in closely adjacent series, prealer bristle short, posthumeral bristle strongly duplicated, apical setulae on scutellum coarser than hairs on ventral surface, sternopleural bristles arranged 1:2; abdomen depressed and broad, thickened caudad, processes lying adjacent one another, with numerous fine sparsely set setulae along inner (ventral) border and with numerous longish bristles along outer (dorsal) border, apical region devoid of bristles and slightly tapering.

Fore tibia with a mid posteroventral bristle, mid and hind femora with a conspicuously long bristle at base of ventral surface and with a series of longish slender bristles on proximal half of posteroventral surface, anteroventral surface of hind femur with a series of longish anteroventral bristles, mid tibia with one anterodorsal, one posterodorsal and two or three posterior bristles, hind tibia with one anteroventral, three anterodorsal and two posterodorsal bristles, apical posterodorsal bristle setulose; wings with *m-cu* cross vein straight, erect. Length, 5 mm.

Type.—♂; Loon Lake, Washington; May 16, 1924; (A. L. Melander). [A. L. Melander Colln.]

Pegomyia cedrica new species

This robust species does not lend itself readily to comparison with other species of the genus for purposes of identification. The strong characters mentioned in the description should serve to eliminate any ambiguities as regards to its recognition.

Male, head with occipital region pale gray, frons and parafacials silvery pruinescent, cheeks and parafacials with reddish to yellowish reflections, face pale, whitish, second antennal segment and greater part of third segment yellowish, palpi yellowish and slightly tinged at apex, proboscis brownish and polished; thorax grayish black as occiput, with whitish gray pruinescence, mesonotum with trace of three brownish streaks, pleura more or less reddish yellow, scutellum entirely yellowish, humeral callosities, propleura and prosternum yellowish; abdomen and legs, including coxae and tarsi, reddish yellow, fifth abdominal sternum polished, amber colored, terga with slight whitish pruinescence except along dorsocentral plane, where a deeper reddish tone is apparent; wings clear, slightly yellowish tinged basad, calyptrae whitish and slightly tinged, halteres yellow.

Frons at narrowest about equal to distance between posterior ocelli inclusive, parafrontals with a pair of minute setulae adjacent anterior ocellus and with four or five pairs of bristles on cephalic half, parafacials at base of antennae prominent, slightly broader than width of third antennal segment, receding ventrad to about half its maximum width, height of cheeks slightly less than maximum width of parafacials, well maintained caudad, third antennal segment about twice as long as second segment, arista minutely pubescent, eyes with a few scattered hairs; mesonotum with acrostical bristles in two very closely adjacent series, prealar bristle short, sternopleural bristles arranged 2: 3, ventral bristles weak, prosternum with a pair of bristles; abdomen short and truncated, depressed cephalad, slightly thickened caudad, dorsum of terga 3, 4 and 5 and prebasal sclerite of hypopygium with a series of well developed marginal bristles, processes short and bare except for a marginal series of slender setulae and a few accessory setulae apicad.

Fore tibia with an anterodorsal and posteroventral bristle, apical posterodorsal robust, mid femur with two or three short slender bristles on posterior surface, mid tibia with an anterodorsal and posterodorsal bristle, two shorter posterior bristles, hind femur with three or four stronger bristles on distal half and four or five much shorter and weaker bristles on proximal half of anteroventral surface, with three or four similarly slender bristles on proximal half of posteroventral surface, hind tibia with an anteroventral, two or three anterodorsal, and two posterodorsal bristles, apical posterodorsal finely developed; wings with *m-cu* cross vein erect, straight, veins M_{1+2} and R_{4+5} slightly divergent distad, costal setulae and thorns weak, inconspicuous, calyptrae subequal.

Female similar to male, interfrontalia reddish yellow and about twice as wide as average width of parafrontal, with or without a weak pair of cruciate bristles, caudal pair of ocellar bristles not longish, directed forward, prealar bristle nearly as long as posterior notopleural bristle, prosternum with a pair of bristles; abdomen broad at base, sharply tapering caudad, fifth tergum nearly twice as long as third or fourth, and with a series of slender marginal bristles, fifth sternum elongate and largely devoid of setulae along ventrocentral plane, sclerites of ovipositor strongly chitinised, polished and blackish, compressed dorsoventrad, with a dense fringe of stiff fine setulae along caudal margin, bristles on proximal half of posteroventral surface of mid and hind femora shorter than in male. Length, 10 mm.

Type ♂ and *allotype* ♀.—Sandusky, Cedar Point, Ohio; May 30, 1903; (J. S. Hine). [Ohio State Univ.]

Pegomyia assimilis new species

This species and the following one are closely allied to *major* Malloch and *incompleta* Stein, both of which have been placed in the genus Eremomyia. The male of *assimilis* has the second antennal segment extensively blackish and the mid femur has no strong bristle on distal half of anteroventral surface.

Male resembling *apicalis* Stein in habitus, head, thorax and abdomen blackish, parafrontals and parafacials silvery pruinescent, cheeks reddish, frontal vitta reddish cephalad, antennae entirely black, palpi fuscous, proboscis subshining; mesonotum with grayish white pruinescence, when viewed from above with well defined dark presutural stripings between the series of acrostical and dorsocentral bristles, macrochaetae set in brownish dots, scutellum with dark brownish marks at basal angles; abdomen with whitish pruinescence and narrow blackish dorsocentral vitta, hypopygium lightly pruinescent; wings hyaline, yellowish tinged proximad, cross veins clouded, calyptrae whitish, halteres yellowish, tinged with purple; fore femur entirely blackish except at apex, mid and hind femora largely blackish, narrowly yellowish at base and broadly so on apical region, tibiae yellow, tarsi black.

Frons at narrowest about as wide as width of third antennal segment, frontal vitta uninterrupted and at narrowest wider than parafrontals, the latter prominent in profile and with eight or nine pairs of bristles, parafacials and cheeks wider than breadth of third antennal segment, the former but little narrowed ventrad, vibrissal area with twelve to eighteen coarse black setulae, third antennal segment 1.5 times as long as wide, arista minutely pubescent, palpi with numerous bristles; mesonotum with three pairs of presutural acrostical bristles, in closely adjacent series, prealar bristle long, posthumeral bristle strongly duplicated, posterior notopleural bristle short and with numerous hairs at base, mesopleura with two or three hairs dorsad of mesothoracic spiracle, sternopleural bristles arranged 2:2 or 3; abdomen stout and conical, sterna with numerous long bristles and setulae.

Fore tibia with one anterodorsal and two posteroventral bristles, apical posterodorsal bristle robust, mid femur with a strong bristle on proximal half of anteroventral surface, but none on distal half, with five or six bristles on proximal half of posteroventral surface, mid tibia with strong anterodorsal and posterodorsal bristles, with two shorter posterior and five strong apical bristles, with no mid anteroventral, hind femur with eight or nine anteroventral bristles and five or six bristles on proximal half of posteroventral surface, hind tibia with two anteroventral, two anterodorsal and two posterodorsal bristles, apical posterodorsal weakly developed, apical bristle on anterior surface robust; wings with costal setulae small, not longer than breadth of costa, *m-cu* cross vein oblique and strongly sinuate. Length, 9.5 mm.

Type.—♂; San Mateo County, California; February 22, 1920; (E. J. Whitney). [Acad. Nat. Sci. Phila., no. 6557.]

Pegomyia thrixia new species

This species may be distinguished from related forms by the possession of a few weak setulae on parafrontals adjacent the ocellar callosity. In addition the anteroventral and posteroventral bristles of hind femora are relatively short and the second antennal segment is extensively blackish. I am of the opinion that the female specimen regarded by Malloch[4] as belonging to *apicalis* (Stein) does not belong to that species but is conspecific with *thrixia.*

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[4] Malloch, J. R. 1918. Diptera from the Southwestern United States. Paper IV. Anthomyidae. *Trans. Amer. Ent. Soc.*, LXIV, p. 303.

Resembling *incompleta* Stein, head, thorax and abdomen black, frons with whitish parafrontals, parafacials and cheeks with silvery pruinescence and reddish reflections, antennae and palpi blackish, proboscis subshining, mesonotum with grayish pruinescence and two dark streaks on presutural area between acrostical and dorsocentral bristles; abdomen viewed from behind with terga 1+2 entirely blackish, terga 3, 4 and 5 whitish pruinescent and with a dorsocentral vitta which becomes uniformly narrower caudad with each successive segment, hypopygium blackish and subshining; all femora largely blackish, narrowly reddish at apex, tibiae reddish, fore and mid pairs darkened, tarsi black; wing membrane clear, slightly yellowish tinged proximad, cross veins faintly clouded, calyptrae clear, halteres purplish.

Frons at narrowest about as wide as length of third antennal segment, frontal vitta at narrowest about equal to breadth of both parafrontals at that point, parafrontals and parafacials prominent in profile, at base of antennae wider than breadth of third antennal segment, parafrontals with eight or nine pairs of bristles and with a few setulae adjacent ocellar callosity, cheeks at narrowest as high as maximum width of parafacials and with a series of robust bristles along ventral margin, vibrissal angle clothed with numerous coarse black setulae, occiput with dense shaggy setulae, palpi with numerous bristles; thorax with numerous setulae, notably on the callosities and scutellum, posterior notopleural bristle short, with numerous setulae at base, prealar bristle long, mesopleura with a few setulae dorsad of mesothoracic spiracle, sternopleural bristles arranged 1: 3; abdomen robust and conical, sterna 1 and 2 with dense slender bristles, sterna 3 and 4 sparsely bristled, hypopygium and processes normal.

Fore tibia with one anterodorsal and two posteroventral bristles, apical posterodorsal bristle robust, mid femur with numerous slender setae clothing ventral surfaces, with a strong bristle on distal half and two or more on proximal half of anteroventral surface, with a series of six to eight bristles on proximal two-thirds of posteroventral surface, mid tibia with a strong anterodorsal and posterodorsal bristle, with. three notably weak posterior bristles and with five robust apical bristles, with a mid anteroventral bristle, hind femur with nine or ten anteroventral bristles and six or seven bristles on proximal half of posteroventral surface, none of which are much longer than maximum breadth of hind femur, hind tibia with two anteroventral, one anterior, two anterodorsal and two posterodorsal, apical anterior and apical posterodorsal bristles robust, pulvilli not strongly developed, fore pair shorter than length of fifth tarsal segment, mid and hind pairs successively smaller. Length, 9 mm.

Type.—♂; Ottuma, Iowa; March 3, 1929; (Jaques). [Acad. Nat. Sci. Phila., no. 6555.]

Pegomyia alticola new species

This species differs from any known to me that belong to the genus *Pegomyia* in that the male has a peculiar pair of accessory sclerites adjoining the fifth sternum, from which arise a prominent series of curved bristles. In the female the fore tibiae are conspicuously infuscated and each has two fine posteroventral bristles.

Male, blackish, frontal vitta deep blackish, cheeks rufous, second antennal segment brownish, third segment entirely black, face grayish black, palpi infuscated apicad, brownish proximad; mesonotum with brownish streaks along planes of dorsocentral bristles; abdomen drab, with faint trace of brownish dorsocentral marking, processes yellowish; coxae infuscated, fore femur fuscous except at basal and apical regions which are yellowish, mid and hind femora yellowish brown and broadly infuscated along dorsum, all tibiae yellowish, fore pairs slightly tinged proximad, tarsi black; wings tinged, veins brownish, calyptrae yellowish, halteres yellow.

Frons at narrowest not as wide as distance between posterior ocelli, parafrontals nearly contiguous cephalad of anterior ocellus, with seven or eight pairs of fine bristles, parafacials and cheeks stoutly developed, oral margin slightly protruded, ventral region of occiput slightly swollen, antennae short, third segment about 1.25 times as long as wide, arista densely but minutely pubescent, presutural acrostical bristles finely developed, the series closely adjacent to one another, prealar bristle in type apparently absent, sternopleural bristles arranged 1:2; abdomen depressed basad, thickened caudad, sides subparallel, terga with slender marginal bristles, fifth abdominal segment with two accessory sclerites, each placed laterad of fifth sternum, the sclerites are sharply tapering caudad and bare except for a dense fringe of long curved bristles along inner margin, processes widely set apart at base, noticeably narrowed apicad, inner margin protruded ventrad as a conspicuous chitinous fold, outer border with a series of fine setulae.

Fore tibia with a posteroventral bristle, apical posterodorsal absent, mid femur with two or three bristles on proximal half of posteroventral surface, mid tibia with no anterodorsal bristle and with three or four short bristles on posterior surface, which are irregularly arranged, hind femur with six or seven fine bristles on anteroventral surface and four to six weak bristles on posteroventral surface, hind tibia with one anteroventral, three anterodorsal, three posterodorsal bristles, apical posterodorsal fine; wings with costal setulae and thorns weakly developed, *m-cu* cross vein straight, veins R_{4+5} and M_{1+2} diverging at wing margin.

Female similar to male but paler, frontal vitta reddish, purplish tinged caudad, parafacials and cheeks largely reddish, palpi yellowish brown, with trace of fuscous apicad, proboscis slender and polished, abdomen with no trace of vitta, fore femur largely infuscated, fore tibia darkened, mid and hind femora and tibiae yellowish brown; wings clear, veins yellowish; frontal vitta with cruciate bristles, caudal pair of ocellar bristles short and directed forward, prealar bristle short, ventral bristle of caudal pair of sternopleurals short and weakly developed, marginal bristles of abdominal terga weakly developed, ovipositor strongly chitinised, fore tibia with one anterodorsal and two posteroventral bristles, mid tibia with one anterodorsal, two posterodorsal, one posterior, one or two posteroventral bristles, all short. Length, 6.5 mm.

Type.—♂; Uintah Mountains, Utah, Mirror Lake; no date. [Acad. Nat. Sci. Phila., no 6556.]

Allotype.—♀; Savonoski, Naknek Lake, Alaska; June 1919; (J. S. Hine). [A.N.S.P.]

Pegomyia tinctisquama new species

The male superficially resembles *marginata* in that the thorax is deep blackish and calyptrae infuscated, but the two species may be readily distinguished from one another by characters pertaining to fifth sternum in male. The palpi in male and female are largely fuscous, and in the latter sex this appendage is abnormally large.

Male, head and thorax blackish, with brownish pruinescence, face blackish, antennae black, palpi entirely fuscous; mesonotum with three presutural dark streaks; abdomen dull reddish or subfuscous, with trace of dorsocentral marking, processes concolorous with abdomen, shining and glossy for the greater part, coxae and fore femora infuscated, tarsi brownish, otherwise legs yellowish, trochanters shiney; wings uniformly brownish tinged, calyptrae and calyptral hairs brownish tinged, halteres yellowish.

Frons at narrowest less than diameter of anterior ocellus, parafrontals with a pair of minute setulae adjacent ocellar callosity and with seven or eight pairs of fine bristles on cephalic half, parafacials at base of antennae about two-thirds as wide as breadth of third antennal segment, cheeks nearly as wide as antennae and well maintained caudad, ventral region of occiput swollen, palpi slender; thorax with three or four pairs of slender presutural acrostical bristles, the series closer to one another than to their respective series of dorsocentral bristles, prealar bristle short, sternopleural bristles arranged 1:2; abdomen depressed, processes lamellate, truncate, polished and bare for the greater part, with a few slender setulae on proximal half of inner border, and with a few bristles at base of outer border.

Fore tibia with one or two posteroventral and with no mid anterodorsal bristle, apical posterodorsal absent, mid femur with four short bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal, one posterodorsal and two posterior bristles, all short, hind femur with a series of four or five bristles on distal half of anteroventral surface, those on proximal half much weaker, with two or more bristles on proximal half of posteroventral surface, hind tibia with one or two anteroventral, three to five anterodorsal, and two posterodorsal bristles; wings with costal setulae and thorns weakly developed, *m-cu* cross vein straight. Length, 4.5 mm.

Female with thorax grayish, humeral callosities and scutellum largely grayish black, occasionally the former and apex of the latter tinged with reddish brown, frontal vitta entirely reddish, parafacials and cheeks reddish, palpi largely fuscous, yellowish at extreme base, proboscis polished, blackish and slender, second antennal segment reddish tinged along apical border; abdomen grayish drab, with reddish tinge prevalent, subshining, no dorsocentral marking apparent, legs with coxae and fore femora more or less brownish, mid and hind femora and all tibiae reddish yellow, tarsi brownish black; wings yellowish tinged, more densely so basad, calyptrae densely yellowish, halteres yellowish or reddish tinged; frontal vitta with cruciate bristles, caudal pair of ocellar bristles longer than postvertical bristles, directed outward, parafacials and cheeks about equal to half width of third antennal segment, palpi very large and conspicuously broadened, with a few short setulae along outer border; mesonotum with a few setulae between acrostical series, posthumeral bristle duplicated, ventral sternopleural bristle of caudal pair short and weakly developed; abdomen with weakly developed marginal bristles, lateral margins of fifth tergum sharply tapering caudad; fore tibia with a weak anterodorsal bristle, mid femur with one to three short weak bristles on proximal third of anteroventral and posteroventral surfaces, anterior series of setulae nearly complete to preapical bristle, posterior surface with two or three preapical bristles, mid tibia with one anterodorsal, one posterodorsal and two to four short posterior bristles, hind femur at most with very weak bristles on posteroventral surface, costa with a perceptible series of fine semierect setulae proximad. Length, 5.75 mm.

Type.—♂; Keremeos, British Columbia; June 20, 1923; (C. B. D. Garrett). [Can. Nat. Coll.]

Allotype.—♀; Banff, Alberta; July 10, 1922; (C. B. D. Garrett). [C.N.C.]

Pegomyia chrysida new species (Figs. 6, 12, 20.)

This species and the four following are closely allied to forms such as *lipsia, duplicata* and *tarsata.* In *chrysida* and *lipsia* the fore tibiae possess no stoutly developed apical posterodorsal bristle. In *chrysida* however the cross veins are clouded and in the female the fore tarsal segments 3 and 4 are only slightly broadened, whereas in *lipsia* the cross veins are clear and the fore tarsal segments are conspicuously broadened in the female.

Male grayish, frontal vitta and vibrissal angle reddish tinged, second antennal segment and proximal half of third segment yellowish, palpi infuscated apicad, proboscis pruinescent, thorax subshining, mesonotum darker than pleura, with brownish dorsocentral marking, bristles set in brownish spots; abdomen densely grayish pruinescent, with narrow brownish dorsocentral vitta, hypopygium concolorous with abdomen, processes brownish tinged, fore coxae yellowish, mid and hind coxae partly infuscated, fore femora fuscous along dorsal half, remainder yellowish, mid and hind femora and all tibiae yellowish, tarsi blackish.

Frons at narrowest about as wide as distance between posterior ocelli exclusive, parafrontals with four or five pairs of bristles, cheeks higher than and parafacials at base of antennae wider than breadth of third antennal segment, the latter nearly twice as long as wide, arista distinctly pubescent; thorax with three pairs of presutural acrostical bristles between which are a few setulae, prealar bristle long, sternopleural bristles arranged 1:2; abdomen cylindrico-conical, marginal bristles stoutly developed, hypopygium and processes as in *lipsia,* sterna 2 and 3 slender and sparsely bristled.

Fore tibia with an anterodorsal and posteroventral bristle, apical posterodorsal setulose, mid femur with no bristles on anteroventral surface, with one or two stout bristles on proximal third of posteroventral surface, mid tibia with a robust mid antero- and posterodorsal bristle, two or three shorter bristles on posterior surface, hind femur with six to eight anteroventral bristles and one or two stout bristles on proximal half of posteroventral surface, the latter has also a preapical bristle, hind tibia with one anteroventral, two anterodorsal and two posterodorsal bristles, apical posterodorsal weakly developed; wing membrane and calyptrae clear or slightly tinged, *r-m* and *m-cu* cross veins clouded, the latter strongly sinuate and oblique, halteres yellow; costal thorn robust, costal setulae inconspicuous.

Female similar to male, frontal vitta blackish caudad, reddish cephalad, abdominal vitta more suffused, all coxae largely yellowish; cruciate bristles absent, caudal pair of ocellar bristles robust and directed outward, marginal bristles of fifth abdominal tergum weakly developed, sterna 2 to 5 slender; fore tarsal segments 3 and 4 slightly broadened, maximum width not more than half length of third tarsal segment, mid femur with a stout bristle near base of anteroventral surface. Length, 10 mm.

Type.—♂; Forest Home, California; 5,200 ft. alt.; May 18, 1934; (A. J. Basinger). [Acad. Nat. Sci. Phila., no. 6558.]

Allotype. — ♀ ; Cave Creek Canyon, Chiricahua Mts., Arizona; 5,500 ft. alt.; no date. [A.N.S.P.]

Paratype. — ♀ ; Mill Creek Canyon, San Bernardino Mts., California; June 7, 1924; (J. M. Aldrich). [U.S.N.M.]

Pegomyia lividiventris new species (Figs. *7, 11, 21.*)

This species may be readily distinguished from allied forms by the more or less reddish color of the abdomen.

Male, head and thorax pale grayish, face grayish, second antennal segment brownish, with distal region broadly yellowish, third segment grayish, yellowish on proximal half, palpi yellow, mesonotum with a brownish postsutural dorsocentral vitta, macrochaetae set in brownish spots, humeral callosity and area adjacent mesothoracic spiracle reddish testaceous, scutellum with brownish marks, prosternum yellowish; abdomen reddish with whitish dust and grayish incisures along caudal margin of terga, with rufous dorsocentral vitta; coxae, femora and tibiae reddish yellow, fore femur with trace of dorsal infuscation, tarsi blackish; wings at most faintly tinged, *m-cu* cross vein faintly clouded, calyptrae white, halteres yellow.

Frons at narrowest not wider than distance between posterior ocelli exclusive, parafrontals with three pairs of bristles, cheeks slightly higher than and parafacials at base of antennae as wide as breadth of third antennal segment, antennae smallish, third segment nearly twice as long as wide; series of presutural acrostical bristles well separated and consisting of three pairs of bristles; prealar bristle long, posthumeral bristle weakly duplicated, sternopleurals arranged 1: 2, scutellum with numerous setulae on disc and lateral declivities; abdomen cylindrico-conical, hypopygium and processes as in *lipsia*, dorsocentral vitta composed of a series of slender substriangular tergal marks, marginal bristles stoutly developed, sterna 2, 3 and 4 elongate.

Fore tibia with a dorsal and posteroventral bristle, apical posterodorsal setulose, mid femur with one or two stout bristles on proximal half of posteroventral surface, mid tibia with one strong anterodorsal and posterodorsal bristle, and two short posterior bristles, hind femur with seven or eight anteroventral bristles and one to three bristles on proximal half of posteroventral surface, hind tibia with one anteroventral, two anterodorsal and two posterodorsal bristles, apical posterodorsal setulose, wings with costal thorn robust, *m-cu* cross vein oblique and markedly sinuate, R_{4+5} and M_{1+2} divergent at wing margin, tarsi slender and longer than tibiae.

Female similar to male, frontal vitta at least reddish on cephalic half, cruciate bristles absent, caudal pair of ocellar bristles longish and directed outward, abdomen with an indistinct dorsocentral mark, marginal bristles on terga 4 and 5 successively weaker developed than those on terga 1+2 and 3, mid tibia with a mid anteroventral bristle, fore tarsus uniformly slender.

Length, 8.5 mm.

Type. — ♂ ; Falls, Forest Home, San Bernardino County, California; Sept. 21, 1935; (A. J. Basinger). [Acad. Nat. Sci. Phila., no. 6559.]

Allotype. — ♀ ; Mt. Home Canyon, San Bernardino Mts., California; June 8, 1924; (J. M. Aldrich). [U.S.N.M.]

Pegomyia cresca new species (Fig. 5, 14, 19.)

This species resembles *tarsata* (van der Wulp), from which it differs in the black color of male processes and in the more restricted size of the second and third fore tarsal segments in the female. Another allied form is *duplicata* (Malloch), in which the second antennal segment is largely blackish and the female fore tarsal segments are uniformly slender.

Male, head grayish black, second antennal segment yellowish, base of third segment reddish, palpi fuscous and paler basad, proboscis pruinescent; thorax grayish drab with brownish infuscation on mesonotum; abdomen more densely grayish pruinescent and with cinereous tinge, abdominal vitta fuscous, hypopygium and processes grayish black, lightly pruinescent, subshining; coxae grayish black, fore femora with blackish infuscation along dorsal surface, mid and hind femora and tibiae yellowish, tarsi blackish; wings and calyptrae clear, faintly tinged at most, halteres yellow.

Frons at narrowest about equal to distance between posterior ocelli, parafrontals with four pairs of bristles, maximum width of parafacial and height of cheek respectively about equal to breadth of third antennal segment, proboscis robust; series of presutural acrostical bristles nearer to one another than to their respective series of dorsocentral bristles, consisting of three pairs of bristles, prealar bristle long, sternopleural bristles arranged 1:2; abdomen cylindrico-conical, marginal bristles robust on dorsum, hypopygium as in *lipsia,* anal sclerite of hypopygium with three or four bristles.

Fore tibia with an anterodorsal and posteroventral bristle, apical posterodorsal robust, mid femur with a stout bristle near base of anteroventral surface, and with two or three bristles on proximal third of posteroventral surface, mid tibia with one robust antero- and posterodorsal bristle, two or three short bristles on posterior surface, hind femur with six to eight stout anteroventral bristles, one or two stout bristles on middle third and a bristle at apex of posteroventral surface, hind tibia with one anteroventral, two anterodorsal and two posterodorsal bristles, apical posterodorsal weakly developed; wings with a robust costal thorn, *m-cu* cross vein oblique and sinuate.

Female similar to male, frontal vitta blackish on caudal half, reddish cephalad, abdominal vitta more diffuse, cruciate bristles absent, caudal pair of ocellar bristles longish and directed outward, fore coxae yellowish, mid and hind pairs infuscated, fore tarsal segments 3 and 4 inconspicuously broadened, maximum width not greater than half length of third tarsal segment, mid tibia with a weak mid anteroventral bristle. Length, 6 mm.

Type.—♂ ;Cranbrook, British Columbia; June 3, 1926; (A. A. Dennys). [Can. Nat. Coll.]

Allotype.—♀ ; Keremeos, British Columbia; July 31, 1923; (C. B. D. Garrett). [C.N.C.]

Paratype.—♀ ; Gull Lake, Alberta; July 7, 1932; (E. H. Strickland). [A.N.S.P.]

Pegomyia fuscicauda new species (Figs. 4, 13, 18.)

The male of *fuscicauda* has the hypopygial sclerites distinctly blackish and lustrous in contrast to the gray opaque color of the abdomen, resembling in this respect *frigida* (Zetterstedt).

Male, head, thorax and abdomen black with pale grayish pruinescence, antennae black, second and extreme base of third segment with trace of reddish, palpi fuscous, proboscis subshining, mesonotum with trace of brownish dorsocentral and sublateral markings, scutellum blackish along declivities and on under surface, subshining, abdomen more densely grayish pruinescent, and with narrow fuscous dorsocentral vitta, hypopygium blackish, subshining, coxae blackish, fore femora infuscated, mid and femora yellowish, with or without infuscation on distal region, tibiae yellow, mid and hind pairs tinged proximad, tarsi black; wings clear, with or without slight infuscation along cross veins, calytrae clear, halteres yellowish.

Frons at narrowest scarcely wider than diameter of anterior ocellus, with three or four pairs of parafrontal bristles, parafacials at base of antennae about as wide as breadth of third antennal segment, narrowed ventrad, cheeks wider than maximum width of parafacials, third antennal segment 1.75 times length of second segment, proboscis stoutly developed; thorax with three pairs of presutural acrostical bristles, with setulae between the series, prealar bristle long, posthumeral bristle weakly duplicated, scutellum with a few discal setulae, sternopleural bristles arranged 1: 2; abdomen conical, processes as in *lipsia,* anal sclerite and basal sclerite of hypopygium with a few scattered bristles, sterna 2, 3 and 4 narrow and elongate, becoming successively broader caudad, sparsely bristled.

Fore tibia with an anterodorsal and posteroventral bristle, apical posterodorsal invariably weakly developed or setulose, mid femur with no bristle on proximal half of anteroventral surface and with two to four stout bristles on proximal half of posteroventral surface, mid tibia with a robust anterodorsal, one posterodorsal, one short posterior situated on proximal half, and one weak posteroventral bristle, mid basitarsus with a sparse series of stout setulae on posterior surface, hind femur with eight anteroventral bristles and with two bristles on median third of posteroventral surface, hind tibia with an anteroventral, two anterodorsal, and two posterodorsal bristles, apical posterodorsal bristle finely developed; wings with *m-cu* cross vein oblique and sinuate, costal setulae small, calyptrae subequal. Length, 6.5 mm.

Female paler than male, parafrontals and mesonotum with seal brown infuscation, abdomen with ill-defined dorsocentral marking; fore femur infuscated along dorsal half, wings faintly tinged throughout, caudal pair of ocellar bristles longish and directed outward; fore tarsus with second, third and fourth segments broadened, mid femur with a stout bristle on proximal half of anteroventral surface, costal thorn robust. Length, 7 mm.

Type ♂ and *allotype* ♀.—Falls, Forest Home, San Bernardino County, California; November 4, 1934; (A. J. Basinger). [Acad Nat. Sci. Phila., no. 6560.]

Paratypes.—2 ♂, 1 ♀; Electron, Washington; May 7, 1925; (A. L. Melander). [A.L.M]

The description of a closely allied species follows.

Pegomyia setiformis new species

Male and female closely resembling *fuscicauda,* differing in that the eyes of male are separated at narrowest part of frons by a distance about equal to that between posterior ocelli inclusive, and the interfrontalia is continued caudad to ocellar callosity as a fine uninterrupted vitta. In the female the frontal vitta is almost entirely deep black. In both sexes the fore femora are infuscated on dorsal and ventral surfaces proximad. The fore and hind tibiae have a well developed apical posterodorsal bristle, mid femur has a bristle near base on anteroventral surface and mid tibia has a weak mid anteroventral bristle. In *fuscicauda* occasional specimens may have one or other of the above characters present but invariably the apical posterodorsal bristle of hind tibia is weakly developed. Length, 8 mm.

Type and *allotype.*—♂ ♀; Waterton, Alberta; July 12, 1923; (H. L. Seamans). [Can. Nat. Coll.]

Pegomyia partita new species

This species as represented in the female sex has the habitus of *labradorensis* Malloch and *semirufa* Ringdahl, from both of which it may be distinguished by the blackish palpi and antennae.

Female with head and abdomen grayish black, thorax entirely reddish and with three dark streaks, parafrontals and parafacials with drab pruinescence, cheeks with reddish reflections, frontal vitta blackish on caudal half, yellowish to orange on cephalic half, face grayish, antennae blackish with trace of reddish on distal border of second segment, palpi and proboscis brownish, the latter shining, legs reddish yellow with trace of infuscation on fore femora, tarsi blackish, wings brownish tinged, calyptrae yellowish, halteres yellow.

Cheeks as high and parafacials at base of antennae nearly as wide as breadth of third antennal segment, the latter about twice as long as second segment, cruciate bristles absent or minutely developed, caudal pair of ocellar bristles longish and directed outward, arista minutely pubescent, presutural series of acrostical bristles closer to one another than to their respective series of dorsocentral bristles, prealar bristle long, posthumeral bristle not duplicated, sternopleural bristles arranged 1:2; abdomen with marginal bristles not stoutly developed.

Legs slender, fore tibia with one anterodorsal and one posteroventral bristle, apical posterodorsal setulose, mid femur with or without a stout basal bristle on anteroventral surface, and with or without one or two fine bristles on proximal third of posteroventral surface, with a stout bristle on distal half of anteroventral surface, mid tibia with a mid anteroventral, one strong anterodorsal, one posterodorsal, and two or three short posterior bristles, hind femur with five to seven anteroventral bristles and with or without a weak bristle at middle of posteroventral surface, hind tibia with one anteroventral, two anterodorsal, two posterodorsal and one posterior bristle on proximal half, apical posterodorsal setulose, fore tarsal segments 3 and 4 slightly broadened, wings with costal setulae and thorns well developed, *m-cu* cross vein slightly sinuate, lower calyptra reduced in size. Length, 5.75 mm.

Type.—♀; Banff, Alberta; August 30, 1922; (C. B. D. Garrett). [Can. Nat. Call.]

Paratype.—♀; Mt. Rainier, White River, Washington; July 20, 1924; (A. L. Melander). [A.L.M.]

Pegomyia banffi new species (Figs. 3, 9, 17.)

This species may be associated with *frigida* (Zetterstedt) and *anorufa* Stein, all of which possess a strong bristle on distal half of anteroventral surface of mid femur. It may be distinguished from related forms by the presence of a bristle on proximal half of posterior surface of hind tibia, and by the absence of apical posterodorsal bristle on fore tibia. In the male the eyes are closely approximated at middle of frons and the cerci are clothed with a dense pubescence.

Male blackish, distal margin of second antennal segment and border of parafacials at base of antennae faintly reddish, third antennal segment black, palpi fuscous, proboscis pruinescent; mesonotum and scutellum with seal-brown infuscation, macrochaetae set in brownish spots, mesonotum viewed from behind with a brownish dorsocentral vitta and paler markings between presutural series of acrostical and dorsocentral bristles, humeral and notopleural callosities, pleura and abdomen grayish drab, the latter with brownish black dorsocentral vitta, hypopygium lightly pruinescent, subshining, coxae more or less yellowish tinged, fore femora blackish along dorsal half and mid and hind femora with traces of infuscation on apical region, otherwise femora and tibiae yellowish, tarsi brownish or black, wing membrane brownish tinged, becoming more intensively yellowish brown basad, cross veins clear, calyptrae yellowish, halteres yellow.

Frons at narrowest about equal to diameter of anterior ocellus, four pairs of weak parafrontal bristles, parafacials at base of antennae about three-quarters width of third antennal segment, cheeks restricted caudad by the occipitogenal margin, third antennal segment nearly twice as long as wide, arista minutely pubescent; series of presutural acrostical bristles closer to one another than to their respective series of dorsocentral bristles, consisting of three pairs of bristles and a few setulae between the series, prealar bristle long, sternopleural bristles arranged 1:2; abdomen conical, slightly depressed, marginal bristles stoutly developed on dorsum and set in fuscous spots, sterna 2 to 4 slender and sparsely bristled, processes short, subcylindrical, with a series of bristles on outer border extending from base to apex, and with a shorter inner series on distal half, inner margin with a few fine hairs apicad, gonostyli slender, shorter than in *lipsia* and more deeply cleft at apex, cerci densely pubescent and subquadrate in outline.

Fore tibia with an anterodorsal and posteroventral bristle, apical posterodorsal setulose, mid femur with or without a bristle near base and with a bristle on distal half of anteroventral surface, with one or two bristles on proximal half of posteroventral surface, mid tibia with one anterodorsal and posterodorsal bristle, and two or three shorter bristles on posterior surface, with a well developed apical posterodorsal bristle, hind femur with six or seven anteroventral bristles, two or three bristles on middle third of posteroventral surface, and a short preapical posteroventral bristle, hind tibia with one anteroventral, two anterodorsal, two posterodorsal and a bristle on proximal half of posterior surface, apical posterodorsal weakly developed, tarsal segments 4 and 5 slightly discoid; wings with costal thorn of moderate length, costal setulae not conspicuously developed, *m-cu* cross vein oblique and sinuate, calyptrae subequal. Length, 6.5 mm.

Female paler than male, frontal vitta largely dull reddish, face grayish black, thoracic and abdominal markings more obscure than in male, fore femur lightly infuscated along dorsal half, mid and hind femora entirely yellowish, wings and calyptrae clear; cruciate bristles weakly developed in allotype, caudal pair of ocellar bristles longish and directed outward, third antennal segment about 1.75 times as long as broad, parafacials and cheeks about as wide as breadth of third antennal segment, cheeks well maintained caudad, mid femur with a stout bristle on proximal and distal halves of anteroventral surface, posteroventral bristles on mid and hind femora few and weakly developed, mid tibia with a short anteroventral, two anterodorsal, one strong posterodorsal and three short bristles on posterior surface, fore tarsal segments 3 and 4 moderately enlarged.

Type.—♂; Banff, Alberta; July 30, 1922; (C. B. D. Garrett). [Can. Nat. Coll.]

Allotype.—♀; Larva Creek, Yellowstone Park, Wyoming; July 5, 1923; (A. L. Melander). [A.L.M.]

Paratype.—♂; Mt. Rainier, Yakima Park, Washington; July 26, 1932; (A. L. Melander). [A.L.M.]

Pegomyia caduca new species

This species conforms closely to the character of *frigida* (Zetterstedt), from which it may be distinguished by the absence of yellowish coloration to wings and calyptrae, lack of lustre or sheen to abdomen and thorax, absence of lateral markings on mesonotum, and by the pruinescence on hypopygium in male.

Conforming closely in structure and chaetotaxy to *frigida* (Zetterstedt). Male densely grayish black, second antennal segment brownish, third segment largely blackish, reddish at basal region, palpi brownish, with apical region fuscous, proboscis pruinescent; mesonotum subshining and with blackish reflections, with brownish dorsocentral vitta and obscure lineal markings; abdomen more olivaceous and more densely pruinescent than thorax, with a deep brownish dorsocentral vitta, macrochaetae set in brownish spots, hypopygium and processes with less dense pruinescence, subshining; coxae grayish anteriorly, fore femur lightly infuscated along dorsal half and proximad, ventral half largely yellowish, mid and hind femora and all tibiae uniformly yellowish, tarsi brownish to black; wings and calyptrae clear, cross veins clear or very slightly tinged, halteres yellow.

Frons at narrowest about equal to distance between posterior ocelli inclusive, maximum width of parafacials slightly less than and height of cheeks as great as breadth of third antennal segment, the latter about 1.5 times as long as wide, arista minutely pubescent, parafrontals with three pairs of bristles; thorax with three pairs of presutural acrostical bristles,

between which are a few setulae, bristles of middle pair closer to one another than to their respective series of dorsocentral bristles, prealar bristle long, sternopleural bristles arranged 1:2; abdomen slightly depressed, gradually narrower caudad, dorsocentral vitta more or less uniformly linear, marginal bristles robust, hypopygium and processes as in *lipsia,* sterna 2 and 3 elongate.

Fore tibia with one anterodorsal and one posteroventral bristle, apical posterodorsal robust, mid femur with a stout bristle on proximal and distal halves of anteroventral surface, and with two or three stout proximal bristles and two or three weak apical bristles on posteroventral surface, mid tibia with one strong anterodorsal and posterodorsal bristle, and with two weak bristles on posterior surface, hind femur with a complete series of uniformly stout anteroventral bristles, and with one or two bristles on middle third and at apex of posteroventral surface, hind tibia with an anteroventral, two anterodorsal and two posterodorsal bristles, apical posterodorsal bristle weakly developed; wings with costal thorn robust, costal setulae weakly developed, veins R_{4+5} and M_{1+2} slightly convergent distad, *m-cu* cross vein oblique and sinuate, lying in a plane which if extended cephalad would intersect costa at a point distinctly proximad of its union with vein R_{2+3}.

Female similar to male, frontal vitta reddish cephalad and purplish or blackish caudad, wing membrance faintly yellowish proximad, parafrontals with a stout pair of reclinate and proclinate bristles at middle, caudal pair of ocellar bristles longish and directed outward, abdomen with marginal bristles of fifth tergum weakly developed, hind femur with anteroventral bristles sparser set than in male, especially proximad, segments 2, 3 and 4 of fore tarsus broadly enlarged, series of costal setulae more noticeably developed. Length, 6.5 mm.

Type.—♂; Mt. Rainier, Yakima Trail, Washington; July 22, 1924; (A. L. Melander). [A. L. Melander Colln.]

Allotype.—♀; Yellowstone Park, Crescent Hill, Wyoming; July 5, 1923; (A. L. Melander). [A.L.M.]

EXPLANATION OF PLATES

PLATE I

Dorsal or caudal aspect of male copulatory appendages.

Figure 1.—*Pegomyia sitiens* new species.
Figure 2.—*Pegomyia pollinosa* Ringdahl.
Figure 3.—*Pegomyia banffi* new species.
Figure 4.—*Pegomyia fuscicauda* new species.
Figure 5.—*Pegomyia cresca* new species.
Figure 6.—*Pegomyia chrysida* new species.
Figure 7.—*Pegomyia lividiventris* new species.

PLATE II

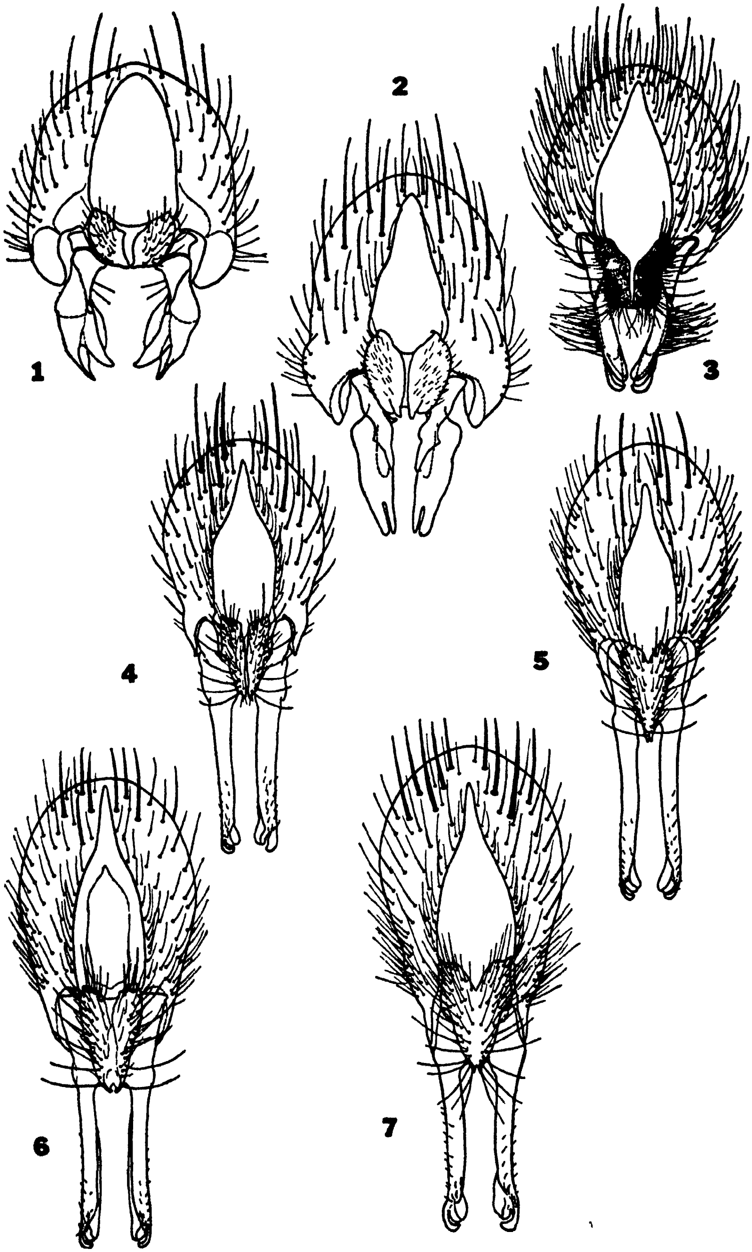
Lateral aspect of male copulatory appendages.

Figure 8.—*Pegomyia pollinosa* Ringdahl.
Figure 9.—*Pegomyia banffi* new species.
Figure 10.—*Pegomyia sitiens* new species.
Figure 11.—*Pegomyia lividiventris* new species.
Figure 12.—*Pegomyia chrysida* new species.
Figure 13.—*Pegomyia fuscicauda* new species.
Figure 14.—*Pegomyia cresca* new species.

PLATE III

Ventral aspect of fifth abdominal sternum in male.

Figure 15.—*Pegomyia sitiens* new species.
Figure 16.—*Pegomyia pollinosa* Ringdahl.
Figure 17.—*Pegomyia banffi* new species.
Figure 18.—*Pegomyia fuscicauda* new species.
Figure 19.—*Pegomyia cresca* new species.
Figure 20.—*Pegomyia chrysida* new species.
Figure 21.—*Pegomyia lividiventris* new species.



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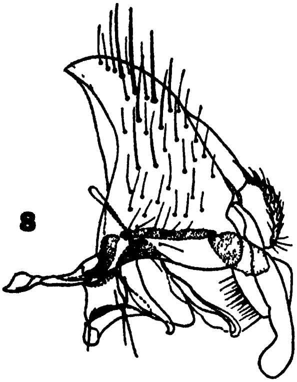

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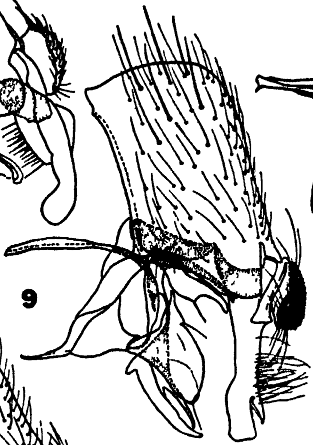

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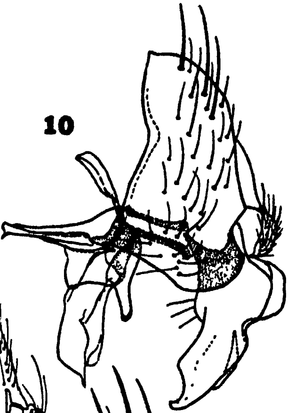

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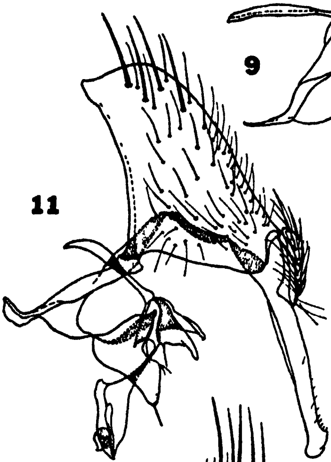

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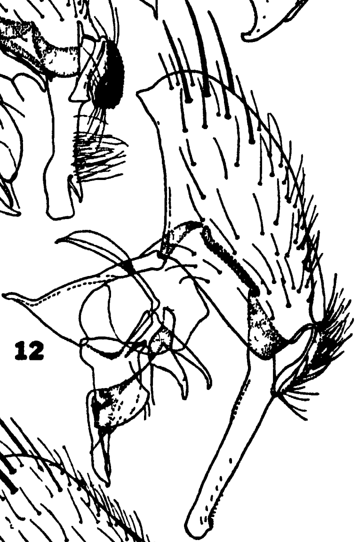

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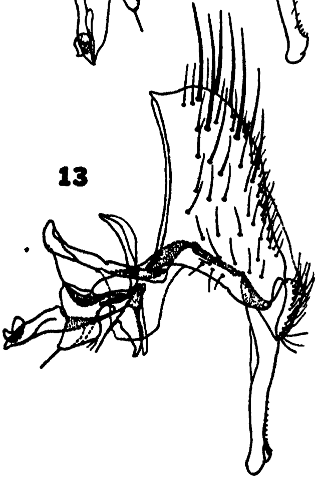

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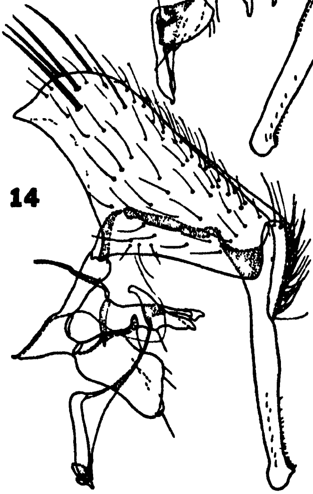
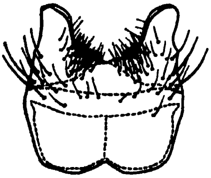


HUCKETT—NORTH AMERICAN PEGOMYIA



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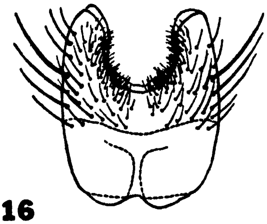

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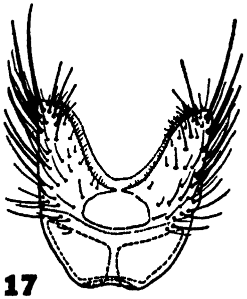

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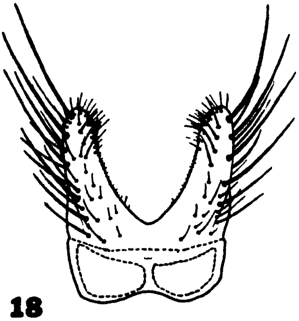

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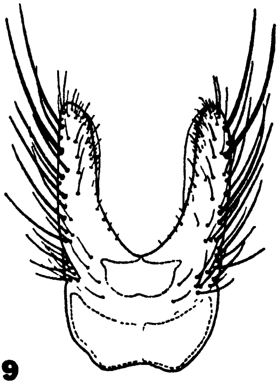

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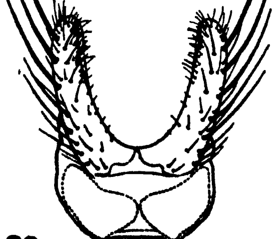

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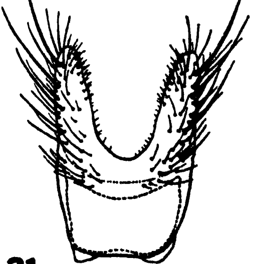

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HUCKETT—NORTH AMERICAN PEGOMYIA

THE ORIENTAL VESPA ANALIS FABRICIUS AND ITS COLOR FORMS, WITH A NOTE ON THE SYNONYMY OF VESPA ESAKII SONAN AND VESPA FORMOSANA SONAN

(HYMENOPTERA: VESPIDAE)

BY J. BEQUAERT

Museum of Comparative Zoology, Cambridge, Massachusetts

Vespa analis Fabricius

Head moderately large. Inner orbits slightly nearer each other at the vertex than at the clypeus. Sides of interantennal shield bluntly keeled. Ocelli placed close together in an equilateral triangle; posterior ocelli twice as far from the inner orbits as from each other. Oculo-malar space at its shortest about half the length of the fourth antennal segment in the female and male, longer in the male than in the female. Clypeus of female coarsely and densely punctate (almost reticulate); its anterior margin with a broad and deep median excision, the edges forming broad, rounded, slightly raised lobes (figured by R. du Buysson for the var. *nigrans*), the notch with a median, triangular, blunt tooth which projects only half as far as the lateral lobes (occasionally the median tooth is small or rudimentary, particularly in the worker). In the male, the clypeus is less coarsely sculptured, its anterior margin slightly curved inward, with the edges broadly rounded off; there is no median tooth, instead a short median longitudinal blunt ridge ending at the apical margin. Lower vertical area of pronotum (between the extension of the humeral carina and the mesopleuron) without transverse ridges. Antennae of male with a pair of pronounced ridged tyloides on the under side of fourth to thirteenth segments, the third with a long low ridge near the apex below; thirteenth segment scarcely longer than twelfth. Both sixth and seventh abdominal sternites of male with a deep, semi-circular median apical excision, the edges of the seventh strongly projecting.

Male terminalia. Lower inner edge of stipes much produced into a strong, broad, slightly spatulate appendage; squama slender, acute, reaching the apex of the spatulate lower edge; volsella of valva interna moderately long, linear; penis slightly widened in apical third, the two apical branches broad, hatchet-shaped, separated by a deep, rectangular notch.

There appears to be little difference in size in this species between the workers and the fertile females (or queens).

I am unable to distinguish, on structural characters, more than one species among the Oriental hornets with a prominent tooth in the middle of the apical notch of the clypeus (in the female). I therefore treat as color forms of *analis*, *V. tyrannica* Smith, *V. parallela* André, *V. nigrans* R. de Buysson and *V. insularis* Dalla Torre (=*japonica* F. Smith). With one exception, the color forms of this species have the sixth abdominal segment of female and worker entirely yellow, orange-yellow or ferruginous. These forms may be separated as follows:

Females and Workers

1. Fourth, fifth and sixth abdominal segments black or faintly blotched with russet. First, second and third segments with extended apical yellow margins; first and second also extensively orange-yellow at the base and with a more or less distinct median brownish-black cross-band. Head mostly orange-yellow. Thorax more or less marked with orange-yellow, particularly on scutellum and postscutellum.
var. *kuangsiana* J. Bequaert
Sixth abdominal tergite and sternite entirely yellow, orange-yellow, or ferruginous 2
2. Head entirely black, dark ferruginous or dull ferruginous-red 3
Head bright yellow or orange-yellow, either entirely or in the lower half only 4
3. Head dull ferruginous-red. Wings strongly infuscate, purplish-black.
var. *barbouri* J. Bequaert
Head dark ferruginous to black. Scutellum and anterior half of first tergite more or less ferruginous. Wings pale yellowish-russet, darker basally and along costa ....typical *analis*
4. Upper half of head black, lower half yellow or orange-yellow. All abdominal segments with apical yellow fasciae, much reduced on first, extensive on the others. Wings slightly infuscate, with russet tinge.
var. *tyrannica* Smith
Head entirely yellow or orange-yellow, at most the vertex with a black spot about ocelli 5
5. Abdomen mostly blackish-brown; sixth segment bright yellow; other segments with reduced yellowish or orange apical margins, covering one-fourth or less of each segment; first and second tergites partly ferruginous, with a yellowish tinge over the basal half. Thorax more or less marked with ferruginous ....var. *nigrans* R. du Buysson
Abdominal segments with extensive apical yellow fasciae, covering about one-third of each segment 6

6. Form of the Asiatic continent and Formosa. Thorax as a rule more or less marked with ferruginous. First and second tergites with distinct orange-yellow basal areas ....var. *parallela* Ed. André
Form of Japan, the Loo Choo Islands and Hainan. Thorax often entirely black. Base of first and second tergites usually black, rarely very slightly orange-yellow ....var. *insularis* Dalla Torre

Of these color forms, only typical *analis*, var. *kuangsiana*, var. *barbouri*, var. *tyrannica* and var. *parallela* are well defined. The var. *insularis* and var. *nigrans* seem to merge with var. *parallela*, and the identification of certain specimens as one of these three is often arbitrary.

Vespa analis typical form

Vespa analis Fabricius, Syst. Ent., p. 363, 1775, (erroneously described as from the Cape of Good Hope). H. de Saussure, Et. Fam. Vesp., II, p. 152, 1854, (♂). R. du Buysson, Ann. Soc. Ent. France, LXXIII (1904), pt. 3, pp. 487, 496, 514 and 629, pl. 9, figs. 1-4, 1905, (♀ ♀ ♂, larva). J. Bequaert, Bull. Brooklyn Ent. Soc., XXIII, p. 54, 1928, (♀; Fabricius' type). [Not *Vespa analis* Fabricius, 1798.]

Vespa crabro sphinx Christ, Naturgesch. Insekten vom Bienen, Wespen und Ameisengeschl., p. 217, pl. 18, fig. 5, 1791, (♀ ♀; without locality).

Vespa analis var. *tenebrosa* R. du Buysson, Ann. Soc. Ent. France, LXXIII (1904), pt. 3, p. 516, 1905, (♀; Goban and Gondang, Java).

Specimens examined.—JAVA: Samarang, 1 male, (E. Jacobson); Buitenzorg, 19 workers and 7 males, (Bryant and Palmer); Onderste Tjiliwoeng, Poentjek, 1 male, (J. van der Vecht); Mt. Salak, 3,000 ft., 2 workers, (Bryant and Palmer); Pelaboean Ratoe, 3 workers (Bryant and Palmer); Depok, 1 worker, (Bryant and Palmer). BALI: Den Pasar, 1 worker, (Awibowo).

I have also seen Fabricius' type in the Banksian Collection.

Typical *analis* has been reliably reported from India (Pondichery; Bengal; Kumaun), Cochinchina, Java and Bali. There is a possibility that it also occurs in Borneo, if the two localities Lawang (? Lawang-Tamang) and Pontiak (? Pontianak), cited by du Buysson, are in that island. R. du Buysson's record from " China " is too vague and questionable. The nest was described and figured by R. du Buysson (1905) from Java. A trigonalid wasp, *Baraeogonalos jezoensis* (Uchida), is an internal parasite of the larva of *V. analis* in Java.[1]

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[1] J. van der Vecht. Tijdschr. v. Entom., LXXVI, Verslagen, pp. lxxviii-lxxxii, (1933). Zoolog. Med. Mus. Nat. Hist. Leiden, XVII, pp. 294-296, (1934).

I am unable to recognize the var. *tenebrosa* as distinct from typical *analis*. R. du Buysson himself says that all transitions occur between the two. Evidently *tenebrosa* was based merely upon individual variants, which will occur in the same nest with typical *analis*.

Vespa analis var. (or subsp.) **barbouri** new variety or subspecies

The darkest form of the species. As only one specimen was seen, it is not certain whether the ferruginous (instead of yellow or orange-yellow) color of the sixth segment is characteristic.

Worker. Head dull ferruginous-red; only the apical margin of the mandibles, with the teeth, black; scape above and most of flagellum strongly infuscate. Thorax black; humeral margin of pronotum extensively ferruginous (on vertical face). Abdomen black; first and second tergites with a restricted ferruginous apical margin; sixth sternite and tergite ferruginous, more yellowish basally. Legs black. Wings strongly infuscate throughout, purplish-black. Length, (h.+th.+t. 1+2); 22 mm.; of fore wing, 23 mm.

Holotype.—Worker; Teesta Valley, Sikkim; (Dr. Thomas Barbour). [Museum of Comparative Zoölogy, Cambridge, Massachusetts.]

Vespa analis var. **tyrannica** F. Smith

Vespa tyrannica F Smith, Cat. Hym. Brit. Mus., v, p. 119, 1857, (☿ or ♀; Singapore).

Vespa parallela var. *biroi* R. du Buysson, Ann. Soc. Ent. France, LXXIII (1904), pt. 3, pp. 487 and 513, 1905, (♀; Singapore).

Specimens examined.—SINGAPORE, several workers, (Baker Coll.—U. S. N. M.).

This striking color form is known only from the type locality. The structure of the clypeus shows that it is a form of *V. analis*. The male is as yet unknown.

Vespa analis var. **parallela** Ed. André

Vespa parallela Ed. André, Ann. Soc. Ent. France, (6), IV, Bull. Séances, p. lxi, 1884, (♀; Vladivostok, Siberia). R. du Buysson, Ann. Soc. Ent. France, LXXIII (1904), pt. 3, pp. 487, 496 and 511, 1905, (☿ ♀ ♂; in part only). Birula, Arch. f. Naturgesch., XC (1924), Abt. A, Heft 12, pp. 89 and 92, 1925, (♀).

Vespa analis var. *parallela* C. L. Liu, Peking Nat. Hist. Bull., XI, pt. 3, p. 215, 1937.

Specimens examined.—CHINA: Fulin, 3,000 to 7,000 ft. 2 workers, (D. C. Graham); Hangchow, 4 workers, (T. P. Chao); Lin-Ngai-Si near Kuanshien, Szechuan, 1 worker, (D. C. Graham); Yen-Ping, 1 worker; Ching-Cheng-Shan, Szechuan, 1 worker, (G. Liu). SIBERIA: S. Ussuri, 1 worker.

This form from China, Manchuria and southeastern Siberia, intergrades with the var. *nigrans*. R. du Buysson's records from Japan all referred to the var. *insularis;* while the specimen he listed from Khasia Hills, India, was most probably of the var. *nigrans*. In southeastern Siberia, the thorax is usually entirely black.

Vespa analis var. **nigrans** R. du Buysson

Vespa nigrans R. du Buysson, Bull. Soc. Ent. France, 1903, p. 175, 1903, (♂; Tse-ku, Yunnan); Ann. Soc. Ent. France, LXXIII (1904), pt. 3, pp. 487, 496 and 527, pl. 5, fig. 6, 1905, (♂, ♀ or ♀). Sonan, Trans. Nat. Hist. Soc. Formosa, XIX, pp. 137 and 141, 1929, (♀ ♀).

Vespa analis var. *nigrans* C. L. Liu, Peking Nat. Hist. Bull., XI, pt. 3, p. 214, 1937.

Specimens examined.—CHINA: Kingfoo-Shan, Szechuan, 1 worker, (G. Liu); Yachow, Szechuan, 5 workers, (D. C. Graham); Wong-Sa-Shui, S. Kiangsi, several workers, (J. L. Gressitt); Suifu, Szechuan, 3 workers and 1 male, (D. C. Graham); Shin-Kai-Si, Mt. Omei, 1 worker; Maan-Chi-Shaan, 1 worker, (C. W. Howard); Shin-Men-Kan, Kweichow, 1 worker; Tseo-Jia-Gao, 1 worker, (D. C. Graham). INDOCHINA: X. Khouang, Laos, female, (R. Vitalis de Salvaza). FORMOSA: Hori, several females, (J. L. Gressitt).

This variety is known from Sikkim, Assam, Laos, Yunnan, southern China and Formosa. The male holotype was parasitized by a Strepsipteron (*Xenos moutoni* R. du Buysson).

Vespa analis var. **insularis** Dalla Torre

Vespa japonica F. Smith, Ent. Mo. Mag, IV, p. 279, 1868, (♂; Hakodadi, Hiogo, Japan); Trans Ent. Soc. London, 1873, p. 198, 1873, (♂ ♀). [Not *Vespa japonica* Radoszkowsky, 1857, nor of de Saussure, 1858]

Vespa insularis Dalla Torre, Cat. Hym., IX, p. 147, 1894. [New name for *Vespa japonica* F. Smith, 1868.]

Vespa tridentata P. Cameron, The Entomologist, XXXVI, p. 278, 1903, (♀; Japan).

Vespa parallela Matsumura, Thousand Insects of Japan, Suppl. 3, p. 101, pl. 38, fig. 9, 1911, (♀). [Not of Ed. André, 1884.]

Specimens examined. — JAPAN: Tokyo, several workers, (Yamada); Fukuoka, Kyûshû, several workers, (K. Yasumatsu); Yakushima Island, Kyûshû, 1 worker, (A. Umeno); Yokohama, 1 worker; Kanagawa, 1 worker; Takayama, several workers, (L. J. Gressitt). LOO CHOO ISLANDS: Okinawa Id., 1 worker, (L. J. Gressitt). HAINAN ISLAND: Ta Hau, 1 worker, (L. J. Gressitt).

This form, known from Japan, the Loo Choo and Riu Kiu Islands, and Hainan, is poorly differentiated from both var. *nigrans* and var. *parallela.*

Vespa analis var. (or subsp.) **kuangsiana** new variety or subspecies

Worker. Head bright yellow; a brownish-black spot on vertex, including ocellar area; teeth of clypeus and inner and apical margins of mandibles black; scape slightly and flagellum strongly infuscate above. Thorax black; narrow humeral margin of pronotum, scutellum, most of postscutellum, and a pair of large spots on the vertical face of propodeum, yellow, shading somewhat into russet. First and second abdominal tergites tricolored; a yellow fascia covering more than the apical third and a basal yellowish-russet area of about the same extent, the two divided by a narrow, ill-defined blackish-brown zone. Third tergite and sternite black with an extended yellowish apical fascia; fourth, fifth and sixth tergites and sternites black, slightly tinged with brown; second sternite yellow, blotched with russet basally. Legs ferruginous to reddish-brown; femora blackish; outer edge of anterior tibiae yellow. Wings slightly smoky, with amber-yellow tinge and russet veins, blackish with black veins near anterior margin. Length, (h.+th.+t. 1+2); 18 mm.; of fore wing, 18 mm.

Holotype.—Worker; Kwangsi, China; (Dr. L. C. Liu). [Museum Comparative Zoölogy, Cambridge, Massachusetts.]

Vespa tropica var. **esakii** Sonan

I was unable to see this form when I wrote my revision of *V. tropica* and *V. affinis.*[2] Through the kindness of Professor T. Esaki and Dr. K. Yasumatsu, I had recently the privilege of studying Sonan's holotype. It agrees structurally with *V. tropica* (Linnaeus), of which it is a color form. It should be noted that the sixth abdominal tergite is only partly orange-yellow (not entirely, as stated in the original description).

Vespa affinis (Linnaeus)

In the paper quoted above, I synonymized *Vespa formosana* Sonan with the typical form of *V. affinis,* on the strength of the description and several Formosan specimens. Dr. K. Yasumatsu sent me recently a specimen of what is called *V. formosana* by Japanese entomologists. It confirms my interpretation of the name.

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[2] Treubia, xv, p. 345, (1936).

STUDIES IN THE RELATIONSHIPS OF THE SUBFAMILIES AND TRIBES OF THE TENEBRIONIDAE BASED ON THE PRIMARY GENITAL CHARACTERS, ALSO DESCRIPTIONS OF NEW SPECIES

(COLEOPTERA)

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(Plates IV, V)

DESCRIPTIVE COMPARISON OF THE PRIMARY GENITAL CHARACTERISTICS OF TENEBRIONID TRIBES FIGURED IN THE ACCOMPANING PLATES

Subfamily Eleodinae, Tribe Amphidorini

The Tribe Amphidorini includes three genera, namely: *Cratidus* LeConte, *Amphidora* Eschscholtz and *Trichoderulus* Blaisdell, in these the primary genital characters of the male are as typical of the Subfamily as those of the Eleodini, differing only in details.

Cratidus osculans LeConte: This species may be taken as a representative of the different congeneric species involved. The primary characters of the males are typical for the three genera and characterized by possessing clavae, articulated with the base of the short middle lobe. The edeagophore is elongate flaxseed-shaped (Pl. IV, fig. 1), less than moderately arched, superior surface smooth, convex and impunctate; apicale triangular with sides evenly arcuate and converging to the subacute apex; base moderately arcuate especially in middle one-third; dorsal surface with an oval, slightly impressed semi-membranous area in about middle one-third. Sides of the apicale are arcuately declivous, moderately and narrowly inflexed ventrally forming the alae (Pl. IV, fig. 3 C), which bound the large and widely open genital fossa, exposing the clavae and middle lobe. The clavae are moderately stout and arcuate, the middle lobe dorsad and visible between them. Basale (Pl. IV, fig. 1 B) has its sides comparatively narrowly inflexed ventrally; viewed from the side not strongly arcuate (Pl. IV, fig. 2). The genital segment of the female possesses the essential characters prevailing in the Eleodini.

Genus *Amphidora*: In *nigropilosa* LeConte the characters are typical of the Eleodinae. In the male the edeagophore is more broadly flaxseed-shaped (Pl. IV, fig. 4*); the apicale triangular with its sides arcuate in basal one-half, thence broadly and rather deeply sinuate to apex, the latter blunt at tip, base broadly arcuate, dorsal surface moderately convex and with an oval, slightly impressed area at middle. The sides of the apicale are arcuately declivous and very narrowly inflexed ventrally in apical one-third, thence gradually wider basad forming rather wide and well defined alae (Pl. IV, fig. 5 C) which scarcely extend basad on the ventral surface of the basale. Clavae well developed (Pl. IV, fig. 5 D), straight, more pointed apically, nearly contiguous on the median line; middle lobe dorsad and visible apically. Middle lobe apparently narrowly ligulate with sides parallel. Basale rather more narrowly inflexed ventrally than in *Cratidus osculans*.

Amphidora littoralis Eschscholtz has the edeagophore rather less broadly flaxseed-shaped (Pl. IV, fig. 13), apicale triangular with its sides broadly sinuate from base to apex rendering the apex more acute; dorsal surface without a membranous area, somewhat broadly and slightly impressed laterally rendering the middle more prominent longitudinally; ventrally the alae are narrower and more differentiated in surface contour than in *nigropilosa;* fissure widely open and the fossa large, the clavae flattened, moderately arcuate and obliquely truncate at apices, the middle lobe partly exposed between them and apically. Basale with the sides more widely inflexed ventrally and apparently secondarily inflexed along their internal margins.

The genus *Trichoderulus* Blaisdell is founded on *longipilosa Blaisdell,* a species from Guaymas, Mexico. It includes *Amphidora caudata* Horn of Arizona, which was not available for study. In *longipilosa* the edeagophore is more fusiform in outline (Pl. IV, figs. 6 and 7) and less flaxseed-shaped. The apicale is more elongate with its sides moderately arcuate in basal one-half, thence broadly sinuate to apex, the latter subacute; dorsal surface convex and with an oval membranous area slightly behind the middle; base feebly bisinuate, slightly and bluntly angulate at middle; inflexed sides forming convex alae ventrally which are evidently not produced onto the basale. Genital fissure not defined, fossa wide and shallow, clavae stout, flattened and contiguous on the median line, completely covering the middle lobe except at the extreme apex. Basale quite strongly convex dorsally; sides arcuately declivous, rather widely inflexed ventrally and secondarily inflexed in their internal one-half, widely separated by the ventral membrane. The female genital segment has the prevailing subfamily characters.

Subfamily Tenebrioninae

In the Tenebrioninae the female genital segments are long and slender. As an example the segment of *Cibdelis blaschkei* Mannerheim is presented (Pl. IV, figs. 10 and 11). The valves are completely divided into apical and basal sclerites; the styli are quite apical and cylindrical; definitely placed long, slender hairs or setae are conspicuous. The basale or valvifer is very elongate. The form and appearances are strikingly different from those observed in the Eleodinae. More or less variation occurs in the different genera.

Subfamily Asidinae

In order to make evident the primary genital characters of the Asidinae, the author has selected specimens of a species of *Stenomorpha* Solier (*Euschides* LeConte, *vide* Hans *Gebien*[1]) that have genital characters fully exposed.

In the male the edeagophore is slender and elongate (Pl. V, figs. 1 and 2). The apicale is nearly as long as the basale and four times as long as wide, its sides are broadly and feebly arcuate, gradually convergent in apical one-half to apex, the latter cleft for a short distance at termination of a brief impressed dorsal line; dorsal surface less than moderately convex, in lateral one-thirds of apical one-half rather coarsely punctate, each puncture on apex with a short seta; on the median line a couple of linear membranous areas are present, these indicate the line of union of the coxites; the sides are inflexed ventrally, narrowly so in apical three-fourths, thence gradually widening at basal fourth to become nearly contiguous but separated by a narrow membranous interval, forming the alae (Pl. V, fig. 2 C), which are convex and truncate at base. Genital fissure not defined, fossa shallow, three-fourths as long as the ventral surface, middle lobe nearly as long as the tegmen (compare with figures 16 and 17 of Pl. V, of the Subfamily Coniontinae). Basale or valvifer long and parallel, slightly constricted just before the base, membranous ventrally along the median line, sides arcuately and narrowly inflexed dorsally (*vide infra* Section 1).

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[1] Katalog der Tenebrioniden (Coleoptera Heteromera), Teil 1, p. 206, (abgeschlossen August, 1936).

In the Asidinae the terminal abdominal segments of the female are capable of being protruded to a remarkable length, an inch more or less according to the species; this is necessary for the manner of oviposition. Each valve of the genital segment can be described as having a dorsal, lateral and ventral plate; the dorsal and ventral plates (Pl. V, figs. 3 G and 5 P) vary in the degree of chitinization may be nigro-piceous or testaceous in color. The lateral plates are specialized, being strongly chitinized and produced apically (Pl. V, figs. 3, 4 and 5 at O), gradually and moderately recurved, superior surface slightly concave ventral surface strongly convex; the apices are adapted to boring or excavating in the soil at time of oviposition; styli very small, scarcely projecting beyond the rim of their fossa, each with a pencil of three or four moderately long setae at apex. Basale very elongate, at least twice as long as the genital segment.

Subfamily Zopherinae

In the Zopherinae the primary genital characters of the male, are radically different from the others given at the present time. The author has selected those of *Phloeodes pustulosus* LeConte to tentatively represent the main characters of the tribes (Pl. V, figs. 6, 7 and 8). The edeagophore (tegmen) is elongate, distinctly parallel and less than moderately arched; apicale of equal width, about three and one-half times as long as wide, fully twice as long as the basale, superior surface (Section 2) only moderately convex from side to side, the later arcuately declivous and widely inflexed ventrally to be contiguous on the median line, forming a somewhat depressed tube, except at apical one-fourth where the apex of the middle lobe is exposed in the genital fossa, the fissure being subfusiform and well defined. The tip of the apicale is broadly and evenly rounded and briefly emarginate at middle; in the apical one-half the dorsal surface is rather coarsely punctate, densely so on the apex, sparsely so in the central area; at each side of the apex the punctures bear moderately long setae. Basale short and its sides narrowly inflexed ventrally and widely separated by the ventral membrane.

COELOCNEMIS Mannerheim

The male primary genital characters of *Coelocnemis californica* Mannerheim are given at the present time simply for comparison, not as representative of the characters of the Tenebrioninae, for this subfamily is undoubtedly polymorphous and when studied it will be found necessary, to transfer and rearrange some of the genera or species now considered related.

In *Coelocnemis* (Pl. V, figs. 9, 10 and 11) the edeagophore in its main structure resembles those of the Eleodinae, but distinctive taxonomic characters are very evident, as the absence of clavae. In the female the genital characters are of the type found in the genus *Cibdelis* (Pl. IV, figs. 10 and 11). Further discussion must be left for a future thesis, after a greater number of species of the different genera shall have been studied.

IPHTHIMUS Truqui

Comparison of the male primary sexual characters of *Iphthimus* (Pl. V, figs. 12 and 13) with those of *Coelocnemis* shows similarities and differences of detail, but the characters of one sex is not sufficient. It is absolutely necessary to determine and correlate the primary characters of both sexes, as can be seen by comparing those of *Cibdelis blaschkei* (Pl. IV, figs. 10 and 11), with those of *Coniontis rugosa* (Coniontinae, Pl. V, fig. 14) and the many species of the Eleodini,[2] to which the student is referred. In that same Monograph the organs of other species of Tenebrionid Tribes are figured, namely: Of *Nyctoporis equicollis* Eschscholtz, male (Pl. 6, fig. 9); of *Cerenopus concolor* LeConte, male (Pl. 6, fig. 5); of *Blaps similis* Latreille, male (Pl. 9, figs. 3 and 4). A study of the figures referred to will indicate the possible taxonomic problems involved in the study of phylogenetic relationships.

Subfamily Coniontinae

The study of the primary sexual characters of *Coniontis rugosa* Casey discloses some very interesting structural characters. The Subfamily includes three Tribes: Branchini, Coniontini and Coelini. In the author's Synopsis and Review of the Species of *Coelus* Eschscholtz,[3] the organs of both sexes are figured.

In the male of *Coniontis rugosa* the apicale of the edeagophore is elongate, almost four times as long as wide, parallel in basal one-half, thence slightly, broadly arcuate and gradually convergent to apex, the latter rather broadly rounded and slightly emarginate at middle; dorsal surface moderately convex and with a median and submembranous impressed line the whole length, terminating at the apical emargination, the surface coarsely punctate laterally and apically in distal two-thirds, punctures denser and setigerous each side of the apical emargination; sides arcuately inflexed dorsally (Section 1), narrowly so in apical two-thirds, thence gradually and arcuately widening to base, the alae not extending onto the basale. Genital fissure widely open and the fossa shallow; the middle lobe fully exposed in apical two-thirds, elongate, extending nearly the whole length of the tegmen (*vide infra* under discussion). The middle lobe when removed (Pl. V, fig. 16) shows a feebly chitinized tegmen that is narrowly inflexed dorsally (Section 1). Basale short, twice as long as wide, distinctly shorter than the apicale, membranous throughout the middle third ventrally; sides arcuately and quite broadly inflexed dorsally and narrowly separated by membrane.

DISCUSSION AND COMMENTS ON THE PHYLOGENETIC RELATIONSHIPS OF THE GENERA AND SPECIES INVOLVED IN THE ABOVE STUDY

According to the accepted Classification of the Coleoptera, the Order is divided into two Complexes: The Isomera and Heteromera, the latter is characterized by having the front and middle tarsi five-jointed; the hind tarsi four-jointed. According to the present taxonomic arrangement the Heteromera include many Families, among which is the Tenebrionidae.

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[2] Mon., Bull. 63, U. S. Nat. Mus., 1909.

[3] Trans. Amer. Ent. Soc., XLV, pl. 33, figs. 4 and 5, (Nov., 1919).

Members of the Family Tenebrionidae are recognized and separated by the following characters:

> Anterior coxal cavities closed behind.
> Ventral abdominal segments five, in part connate.
> Tarsal claws simple, the penultimate joint of tarsi not spongy beneath.

For the purposes of the present studies, the Tenebrionidae may tentatively be divided into two Sections, from the position of the edeagophore or tegmen of the male as follows:

Section 1. The tegmen when at rest within the body and when protruded has the middle lobe superior in position, (or up-side-down, compared with the position in Section 2) as in the Tentyrinae, Coniontinae and Asidinae, the latter includes the Tribes Craniotini and Asidini.

Section 2. The tegmen when at rest within the body and when protruded has the middle lobe inferior in position, or right-side-up, the opposite to that in Section 1, as in the Eleodinae, Tribes Eleodini and Amphidorini; Helopinae, Tribes Stenotrichini and Helopini; Blaptinae, Zopherinae and many other Subfamilies.

The present preliminary study has determined some very positive and suggestive facts regarding subfamily and tribal relationships as at present supposed or accepted. Some of these facts will now be considered.

The members of a Subfamily should consist of those species that have descended from a common ancestral form. That being the case, the Tribe Eleodini as now considered as in no way closely related to the Blaptinae (*Blaps* of Europe etc.), but belongs to the Subfamily Eleodinae, the members of which have had their origin in western North America, in the Sonoran Regions of the United States and Mexico. The primary genital characters of the males of the Eleodinae possess clavae attached to the base of the short middle lobe; further more the species of the west coast fauna of North America, now referred to the Subfamily Adeliinae and placed before the Helopinae in our lists, are in no way closely related to those two Subfamilies, but belong to the Eleodinae, Tribe Amphidorini. To verify this relationship compare the figures given in this study with those of the male primary characters of the Eleodini given in the author's Monograph. *Stenotrichus rufipes* LeConte is at present associated with the species of *Cratidus* and *Amphidora* to which it is in no way closely related; its primary genital characters are identical with those of the more cylindrical species of *Helops* and, therefore must be associated under the Helopinae, Tribe Stenotrichini. Such changes just suggested render the Eleodinae homogeneous.

The Asidinae possess distinctive primary sexual characters, the typical characters are described above and figured in Plate V. The species *Craniotus pubescens* LeConte heretofore placed after the Edrotini, and before the Zopherini in our lists, belongs to the Subfamily Asidinae, Tribe Craniotini, its genital characters being distinctly of the type found in that Subfamily. The author has reported this fact in a previous publication.

The Coniontinae is at present widely separated in our lists from those with which the subfamily characters are most in harmony. From its present position between the Eleodinae and Pedininae, it must be transferred to a place after the Tentyriinae, probably before the Epitragini, not because of supposed origin from a common ancestral form, but of the structural characters, future studies must decide.

The Tribe Zopherini should be placed in the Subfamily Zopherinae. According to Hans Gebien the type of the genus *Zopherus* is the *mexicanus* Gray of Mexico. The primary genital characters are very distinctive for the Subfamily, which stands quite isolated in the American fauna; many more species of the related genera must be studied before their relationship can be determined. Regarding *Zopherosis* Sharp and Muir have written: [4] "In the type of the Nosoderma group we have examined (*Zopherosis*) there exists a distinction from *Pediris* that we must treat as of considerable importance, in as much as the chitinisation of the tegmen occurs on the ventral aspect of the lateral lobes, being united in that position. This suggests that a complete sundering of the Tenebrionidae will be found necessary."

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[4] Trans. Ent. Soc., London, 1912, Pt. 3, p. 625, (Dec. 1912).

The primary sexual characters of the species of *Centronopus* are distinctive of the genus. *Centronopus suppressus* Say of Mexico, should be transferred to the genus *Scotobates* Horn as its primary characters are radically different from those of *Centronopus* and identical with those of *Scotobates calcaratus* Fabricius.

Further remarks cannot be made at this time regarding *Cibdelis, Coelocnemis* and *Iphthimus.* The figures given in the plates with this study will be suggestive. The author expects to present another paper in the near future, when more shall have been determined regarding the genera and species of the different Tenebrionid Tribes.

The new genus and species described below (*Eleodopsis subvestitus*) is isolated and not closely related to any known species in the United States and Mexico. Its facies resembles that of *Blapylis inculta* LeConte which inhabits Santa Rosa Island. Its primary genital characters are radically different from any species thus far examined. The species will have to be placed in a new Family and Tribe, namely Eleodopsinae and Eleodopsini and, arbitrarily placed after the Eleodinae in the catalogue, this is justified by its facies but not from the archaic genital characters.

DESCRIPTION OF A NEW GENUS AND SPECIES FROM SAN NICOLAS ISLAND AND A NEW ELEODES FROM ARIZONA

In November, 1911, Mr. J. R. Slevin of the Department of Herpetology, California Academy of Sciences, visited San Nicolas Island,[5] remaining there several days (October 7th to the 12th).

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[5] San Nicolas Island is 53 miles off the nearest point of the coast of California and belongs to Ventura County, it is the outermost Island of those off the coast of Southern California It is 43 miles westward from San Clemente and 24 miles southwestward from Santa Barbara Island. It is 8 miles long in an east-and-west direction, with an average width of three miles; the highest point is 890 feet. Two-thirds of the Island is covered with sand, the remainder with coarse grass and a few patches of scrub oak. It is surrounded by kelp, except two miles at the northwestern extremity, Corral Harbor on the north side of the Island, three and one-half miles from the western point, affords a good boat landing. The entrance is 20 feet wide with a basin 60 feet in diameter inside, having a smooth sand beach and quiet water. (United States Coast Pilot, Pacific Coast, Dept. of Commerce, United States and Geodetic Survey, 1926, pp. 56-57.)

During that time he collected a series of a species of Tenebrionidae, from under flat rocks just above high water mark at margin of the beach, about the middle of the north side of the Island.

The species has been of much interest on account of its doubtful relationship to the main land species belonging to the subgenus *Blapylis* (Eleodini) or to the genus *Amphidora* (Amphidorini nec Adeliinae, *vide supra*). A study of the primary genital characters shows that the species is not related to the Eleodini,[6] nor to the Amphidorini as represented by the known species of the United States and Mexico. The species is of a more archaic type, in body-form resembling *Blapylis inculta* LeConte which inhabits Santa Rosa Island.

The species collected by Mr. Slevin is new and belongs to a new genus and represents a new Tribe at least. It it not closely related to any species listed from North America that the author has been able to determine. It is described as follows:

ELEODOPSIS new genus

GENOTYPE: *Elcodopsis subvestita* new species.

Form robust, somewhat resembling *Blapylis inculta* LeConte, nigropiceous in color, more or less sparsely pubescent, hairs grayish in color, longest on sides of the body. Mentum trilobed. Antennae slender, last three segments slightly wider than the preceding, setae short, sensory areas more or less rufous and clothed densely with very short grayish pubescence. Pronotal disk evenly convex, lateral marginal bead fully visible from above. Femora mutic in both sexes. Protibiae noticeably arcuate and somewhat compressed, external margins subcarinate, their outer or posterior surfaces rather strongly spinose; apex of each rather deeply sinuate laterally, due to the obliquity of the corbel, which receives the first protarsal segment when fully extended against the tibia. Tibial spurs acute, moderate in length, the external shorter. External marginal spinules of tibial apices, short, flattened and oblong, truncate at tips, the internal slender and sharp.

Male: First two segments of the protarsi with pubescent tufts beneath, third segment at the apical margin; fourth plantar grooves open. First two abdominal segments impressed at middle.

Female: First protarsal segment thickened at apex beneath, plantar grooves feeble on the other segments; apical spinules narrowly closing the groove of second segment. Abdominal segments moderately convex.

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[6] Blaisdell, F. E., A Monographic Revision of the Eleodiini, *Bull.* 63, *U. S. Nat. Mus.*, p. 331, (1909).

Generic genital characters.—Male: Form of the edeagophore or tegmen very different (Pl. IV, figs. 8 and 9) from those of the Eleodinae (Eleodini and Amphidorini). Apicale elongate, membranous dorsally on the median line; sides narrowly inflexed ventrally in apical third, thence rather rapidly widening to become wide and contiguous in basal two-thirds, genital fissure widely open, median lobe ligulate and well exposed, clavae absent (present in the Eleodinae). Basale evidently not or feebly chitinised. Female: General form of the genital segment (Pl. IV, figs. 14 and 15) similar to those observed in the Eleodinae. Dorsal plate of each valve not distinctly differentiated from the apex and, continuous with the ventral plate, the latter divided into an apical and a basal sclerite, separated by a suture that ends laterally and not visible from above; sides smooth and not beaded. Apical appendages (styli) small. Surfaces of the valves pitted with small oval impressions, each with a very short hair.

Eleodopsis subvestita new species

Form robust, slightly ovate, about twice as long as wide. Color nigropiceous to black, luster dull, pronotal disk somewhat shining. Body very sparsely clothed with ashy or yellowish hairs, longest on the sides and beneath, very short on the pronotal and elytral disks.

Head twice as wide as long before the post-ocular line, widest across the eyes or sides of the front, the latter rather strongly arcuate and somewhat prominent, thence converging and straight, continuously so with the straight sides of the epistoma, but very broadly and slightly emarginate across the oblique sutures; epistomal apex broadly and moderately feebly emarginate, angles rather narrowly and obtusely rounded. Labrum with a small, deeply arcuate sinus at middle of apex, sides rather strongly arcuate to base. Frons nearly plane, supra-antennal convexities moderately convex and impressed at the anterior margins of the eyes, rendering the latter more prominent, causing the facets for the most part to be directed forwards; punctation rather coarse, dense, punctures separated by a distance equal to their diameter or less, a little coarser and more or less confluent on the epistoma, obscuring the fine oblique and frontal sutures, smaller on the vertex and occiput; tempora a little less prominent than the eyes, densely punctate and setigerous. Eyes short, transverse, slightly oblique, a little larger above than below, facets small and convex. Antennae similar in the sexes, slender, in length extending two or three segments beyond the pronotal base; distal three segments but slightly wider and feebly compressed; second segment short, somewhat annular and as wide as long, third elongate, subcylindrical and twice as long as the fourth; segments four to six inclusive cylindro-obconical and quite equal in length exclusive of the condyles and, about one-half longer than wide at apex, seventh and eighth somewhat triangular in profile and widest at apex; ninth suboval, sides straight and not longitudinally arcuate; tenth oval, slightly wider than long, eleventh short, somewhat irregularly oval, a little longer than wide and rather obliquely truncate at apex.

Pronotum one-third wider than long, apex truncato-emarginate, angles narrowly rounded, very feebly prominent if at all; sides broadly arcuate, slightly convergent and a little straighter anteriorly; base feebly and broadly arcuate, a little wider than apex, angles moderately well rounded; disk smooth, evenly convex rather coarsely, irregularly and densely punctate, punctures separated by a distance equal to two or three times their diameter to much less.

Elytra short oval, about one-fourth longer than wide and, two and one-half times as long as the pronotum; base transverse; sides broadly arcuate and rather broadly parabolic at apex; disk moderately and evenly convex, rather sharply and arcuately declivous laterally, sides moderately inflexed, arcuately precipitous in apical two-fifths; surface densely but not strongly micro-rugulose, the slightly muricate punctures moderately dense.

Abdomen more or less polished, irregularly and moderately densely punctate; segments more or less longitudinally, sparsely rugose. Legs moderate in length and densely sculptured. Metafemora and tibiae nearly equal in length; tarsi three-fifths as long as their tibia, first and fourth segments equal in length, each twice as long as the second or third, which are equal to each other. Tibial spurs small and subequal.

Male: First two abdominal segments distinctly impressed in middle one-third; fifth segment as long as the third and fourth together, otherwise as in the female.

Female: Usually somewhat broader than the male. Abdomen moderately convex, not impressed; first segment twice as long as the second and equal to the fourth and fifth together, third and fourth equal and one-third shorter than the second.

Measurements: (Types) Length, 11 to 11 mm.; width, 6 to 7 mm.

Genital characters.—Edeagophore or tegmen (Pl. IV, figs. 8 and 9) relatively very small and primitive, depressed, not arched at apex, measuring in length 1.75 mm., and in width .5 mm. Apicale (Coxite of Tanner) elongately triangular, apex linearly emarginate, the emargination continuous with a dorsal impressed line in apical one-fifth, thence linearly membranous, gradually widening to base (line of union of the coxites of Tanner); sides arcuately deflexed and inflexed ventrally, narrowly in apical one-third, thence rather rapidly widening to become contiguous in basal two-thirds, forming the alae which do not extend basad on the basale (valvifer); apically forming the boundaries of the genital fissure, fossa large and shallow containing the ligulate middle lobe, clavaè absent (present in the Subfamily Eleodinae). Basale not or very feebly chitinised, in specimens studied obscured by membrane.

Female: Aedeaga or genital segment (Pl. IV, figs. 14 and 15) viewed from above of the usual subquadrate or triangulo-quadrate form, depending on the degree of abduction or adduction of the valves (coxites of Tanner). Color luteo-testaceous, not strongly chitinised, surface pitted throughout with small oval to fusiform depressions, each with a short, pale hair. Each valve from above appears subconical in outline, dorsal plate slightly convex, transversely and arcuately continuous laterally with the ventral plate without a lateral margin, side converging to apex from which it is not defined. Apex small, smooth and shining, convex and without visible pubescence; its ventral surface less convex and more broadly rounded at tip. Appendage lateral, very small, short oval and submammilliform, with a pencil of about four hairs projecting from the apex; internal margin of dorsal plate broadly arcuate, basal margin slightly arcuate.

Ventral plate of each valve is divided into two sclerites, an apical and a basal, together about one-fourth longer than the dorsal plate. Inner margin of the apical sclerite moderately arcuate in apical third, smooth and shining; basal sclerite subquadrate, less than one-third as long as the dorsal plate, longer internally than laterally, basal margin outwardly oblique, suture ending at the lateral margin and not visible from above.

Holotype.—Male; San Nicolas Island; November 1-12, 1911; (J. R. Slevin). [Collection Cal. Acad. Sci., no. 4756.]

Allotype.—Female; with same data. [Cal. Acad. Sci., no. 4757.]

Paratypes.—14 specimens with same data. Distributed: Colln. California Academy of Sciences, 12; Colln. American Entomological Society, 2.

A New Melyrid from North Coronado Island, Mexico

Eleodes (Melaneleodes) lineata new species

In *lineata* the frons is plane, the elytra have well marked and noticeably impressed striae of punctures, the series of the latter may show brief areas of gemination; the intervals are more or less but not strongly convex, never subcostiform as in *porcata* Casey; the surface luster is more or less dull, the males are elongate and more or less subfusiform, the females more or less ovate. The species has to be differentiated from *ampla* Blaisdell and *nitida* Casey.

In *ampla* the body form is similar, the elytral striae are not in the least impressed, punctures small and the intervals flat. In *nitida* the body form is less subfusiform to subovate in the male, surface more shining and smooth; elytral striae not impressed, intervals flat, strial punctures and those of the intervals small and subequal; pronotal sides are more parallel and less arcuate, on account of being more strongly declivous, the pronotum appearing subquadrate.

Form elongate subfusiform to ovate, size moderately large. Color black, luster dull and alutaceous. Elytra distinctly punctato-striate, intervals somewhat convex.

Head relatively small, twice as wide as long before the post-ocular line, equally wide across the sides, eyes and tempora; sides not prominent, briefly parallel just before the eyes, thence arcuately oblique and converging to the oblique suture, not quite in line with the sides of the epistoma, the latter straight and moderately convergent; epistomal apex slightly and broadly truncato-emarginate, angles well rounded. Frons plane, not convex over the antennal insertions, slightly declivous against the eyes, sutures fine and more or less obsolescent, vertex moderately convex; surface finely and sparsely punctate, punctures subequal, irregular and separated by a distance equal to twice to six times their diameter; tempora not prominent, converging posteriorly from the eyes, the latter short, narrowly reniform, facets not convex. Labrum visibly transverse, sides feebly arcuate and continuously so with the well rounded angles; apex briefly and rather deeply, arcuately, rather abruptly emarginate, rendering the apex bilobed, each lobe apically, densely fimbriate with ferrugenous setae; surface densely punctate laterally, each puncture with a rather long stiff seta, sparsely punctate centrally, setae short.

Antennae elongate and slender, scarcely attaining the pronotal base, distal four segments slightly incrassate and equal in width; segments three to seven inclusive cylindrical; second short, annular and one-fourth as long as the third; the latter feebly obconical, four times as long as wide at apex; segments four to seven quite equal in width and length, twice as long as wide and one-half as long as the third; eighth subtriangular, as long as wide, twice as wide at apex as at base; ninth and tenth rather irregularly spherical, eleventh obtusely obovate, little longer than wide and slightly truncate at apex.

Pronotum subquadrate, a little wider than long, widest at about junction of apical and middle thirds; apex feebly emarginate, angles very narrowly rounded, scarcely prominent anteriorly; sides feebly and broadly arcuate in anterior two-thirds, less so and straighter to base, marginal bead fine and scarcely visible from above; base broadly and feebly arcuate, a fourth wider than apex, angles obtuse but angulate, basal bead wider; disk evenly convex, very moderately and arcuately declivous laterally, smooth, very sparsely punctulate.

Elytra oval, widest at middle, two-thirds longer than wide; base slightly emarginate, equal to the pronotal base, humeri small and subacute, not in the least prominent; sides broadly arcuate and subparallel to somewhat widest behind the middle, arcuately subogival at apex; disk rather evenly arcuately declivous laterally and well inflexed, arcuately and obliquely declivous in apical one-fourth, surface regularly striate with small and closely paced punctures, striae somewhat impressed, intervals narrow and moderately convex, with scattered small punctures. Some of the strial series are double in places.

Abdomen smooth and more or less shining, finely and sparsely punctate. Legs moderately long and slender, tarsi likewise slender.

Male: Elongate subfusiform. Abdomen feebly convex, flattened on first three segments.

Female: Ovate, elytra distinctly wider than the prothorax. Abdomen moderately convex.

Measurements: (Types) Length, 19 to 21 mm.; width, 6 to 9 mm.

Holotype.—Female; Chiricahua Mts., Arizona; August 5, 1933; (Owen Bryant, lot no. 417). [Author's collection, California Academy of Science, no. 4805.]

Allotype.—Male; with same data. [Cal. Acad. Sci., no. 4806.]

Paratypes.—12; with same data in part. Distribution: Colln. American Entomological Society, 2; Colln. Owen Bryant, 6; Colln. of the author, California Academy of Sciences, 4.

One specimen, female, has the elytra more inflated and strongly convex, almost cylindrically so; collected in the Chiricahua Mts. of Southern Arizona, May 25, 1908.

Listrus coronadensis new species

This is a small aeneous species easily recognized by its habitat and, by the resemblance of well developed specimens to *definitus* Fall of the mainland, but without the acuminate elytral sutural angles in the female.

Form elongate, parallel to slightly ovate, size small, about three times as long as wide. Color black with a distinct aeneous luster; antennae and legs rufo-testaceous, first antennal segment very black, the distal four more or less fuscous. Pubescence moderately dense, not hiding the surface, fine and recumbent, pale for the most part, that of the head and pronotum intermixed with cupreous hairs, pronotal lateral vittae and central clepsydriform macula feeble or obsolete. Elytra with a dark subapical fascia which does not attain the lateral margins, narrowest in lateral thirds widest across the suture, its edges irregular and more or less intermingled with cupreous hairs; in basal two-thirds there are scattered hairs and indefinite small maculae of cupreous color. Pronotal lateral fimbriae pale and short, those of the elytra a little longer and straight, scutellum albido-pubescent. Hairs of the under surface of body longer finer and ashy in color, dense and white on the episterna.

Head small and transverse, about one-third wider than long before the post-ocular line, muzzle short, sides convergent anteriorly before the prominent and feebly setigerous eyes; epistomal apex transverse, labrum small and semi-circular, frontal sutures obsolete; frons broadly and feebly impressed, a slight glabrous tumescence on the median line against the epistomal base, punctures small, discrete and separated by a distance equal to about twice their diameter. Antennae moderately stout, extending to about basal fourth of the pronotum, distal four segments slightly incrassate, eighth, ninth and tenth somewhat spherical; second segment oval, equal to the third in length, the latter somewhat cylindro-obconical and twice as long as wide near apex; segments four to seven inclusive differing slightly in the sexes.

Pronotum slightly wider than long, slightly narrower than the elytral base across the humeri; apex arcuato-truncate in moderate circular arc, distinctly narrower than the base; sides moderately strongly arcuate, a little less so and a little convergent anteriorly, basally broadly and semicircularly arcuate with the base; disk widest in basal third, strongly convex, rather more declivous antero-laterally, punctures as on the head, well defined, separated by a distance equal to their diameter, a little closer laterally, intervals smooth, scarcely indented.

Elytra a little less than twice as long as wide, about three times as long as the pronotum; base feebly emarginate, humeri not in the least prominent, umbones very small or obsolete; sides parallel, apex subparabolically rounded; disk feebly convex, arcuately declivous laterally, more gradually so apically, quite densely punctate, punctures a little larger than on the pronotum and feebly impressed.

Abdomen feebly convex, surface finely crinkled, punctures minute. Legs moderate in length and rather slender, femora not inflated; metafemora straight and not arcuately adapted to sides of the body; metatibiae equal in length to their femora.

Male: Parallel, elytra quite equal in width; fifth abdominal segment truncate at apex, surface not modified.

Female: Slightly ovate, widest at the posterior third of the elytra. Head and pronotum relatively smaller than in the male; antennae less stout, fourth segment not triangular and there is less difference in width between the following segments. Fifth abdominal segment longer and arcuate at apex.

Measurements: (Types) Length, 2.5 to 2.6 mm.; width, 1 to 1.2 mm.

Holotype.—Male; North Coronado Island, Mexico; May 6, 1928. [Author's collection, California Academy Sciences, no. 4803.]

Allotype.—Female; with same data. [Cal. Acad. Sci., no. 4804.]

Paratypes.—35; with same data. Distribution: Author's collection, 6; Colln. Natural History Museum, Balboa Park, San Diego, California, 25; Colln. American Entomological Society, 4.

EXPLANATION OF PLATES

Index to the lettering: A, apicale of the edeagophore or tegmen of Sharp and Muir; B, basale of the edeagophore; C, inflexed sides of the apicale forming the alae; D, clavae; E, middle lobe; F, inflexed sides of basale or valvifer; G, dorsal plate of valve of female genital segment; J, apical sclerite of dorsal plate of valve when divided into two parts, female genital segment; K. basale or valvifer (Tanner) of female; L, proctiger; M, basal sclerite of ventral plate of valve when consisting of two parts, female; N, apical sclerite of ventral plate of valve, female; O, lateral plate of valve, strongly chitinized, female; P, ventral plate of valve, female.

PLATE IV

Fig. 1.—Aedeagus of *Cratidus osculans* LeConte, male; dorsal view when *in situ.*

Fig. 2.—Aedeagus of *Cratidus osculans* LeConte, male; lateral view.

Fig. 3.—Aedeagus of *Cratidus osculans* LeConte, male; ventral view when *in situ.*

Fig. 4.—Aedeagus of *Amphidora nigropilosa* LeConte, male; dorsal view when *in situ.*

Fig. 5—Aedeagus of *Amphidora nigropilosa* LeConte, male; ventral view when *in situ.*

Fig. 6—Aedeagus of *Trichoderulus longipilosa* Blaisdell, male; dorsal view when *in situ.* Specimen from Guaymus, Mexico

Fig. 7.—Aedeagus of *Trichoderulus longipilosa* Blaisdell, male; ventral view when *in situ.*

Fig. 8.—Aedeagus of *Eleodopsis subvestita* new species, male; dorsal view when *in situ.* Habitat: San Nicolas Island.

Fig. 9—Aedeagus of *Eleodopsis subvestita* new species, male; ventral view when *in situ.*

Fig. 10.—Aedeaga of *Cibdelis blaschkei* Mannerheim, female; dorsal view when *in situ.*

Fig. 11.—Aedeaga of *Cibdelis blaschkei* Mannerheim, female; ventral view when *in situ.*

Fig. 12.—Aedeagus of *Amphidora littoralis* Eschscholtz, male; ventral view when *in situ.*

Fig. 13.—Aedeagus of *Amphidora littoralis* Eschscholtz, male; dorsal view when *in situ.*

Fig. 14.—Aedeaga of *Eleodopsis subvestita,* new species, female; dorsal view.

Fig. 15.—Aedeaga of *Eleodopsis subvestita,* new species, female; ventral view.

Plate V

Fig. 1.—Aedeagus of *Stenomorpha*[7] Solier (*Euschides* LeConte) species, male; ventral view when *in situ*.

Fig. 2.—Aedeagus of *Stenomorpha* Solier, male; dorsal view when *in situ*.

Fig. 3.—Aedeaga[8] of *Stenomorpha* species, female; dorsal view when *in situ*.

Fig. 4.—Aedeaga of *Stenomorpha* species, female; lateral view.

Fig. 5.—Aedeaga of *Stenomorpha* species, female; ventral view.

Fig. 6.—Aedeagus of *Phloeodes pustulosus* LeConte, male; dorsal view when *in situ*.

Fig. 7.—Aedeagus of *Phloeodes pustulosus* LeConte, male; lateral view.

Fig. 8.—Aedeagus of *Phloeodes pustulosus* LeConte, male; ventral view when *in situ*.

Fig. 9.—Aedeagus of *Coelocnemis californica* Mannerheim, male; lateral view.

Fig. 10.—Aedeagus of *Coelocnemis californica* Mannerheim, male; dorsal view when *in situ*.

Fig. 11.—Aedeagus of *Coelocnemis californica* Mannerheim, male; ventral view when *in situ*.

Fig. 12.—Aedeagus of *Iphthimus sublaevis* Bland, male; dorsal view when *in situ*.

Fig. 13.—Aedeagus of *Ipthimus sublaevis* Bland, male; ventral view when *in situ*.

Fig. 14.—Aedeaga of *Coniontis rugosa* Casey, female; ventral view of genital segment.

Fig. 15.—Aedeagus of *Coniontis rugosa* Casey, male; ventral view when *in situ*.

Fig. 16.—Middle lobe of aedeagus of *Coniontis rugosa* Casey, male; dorsal view when *in situ*.

Fig. 17.—Aedeagus of *Coniontis rugosa* Casey, male; dorsal view when *in situ*.

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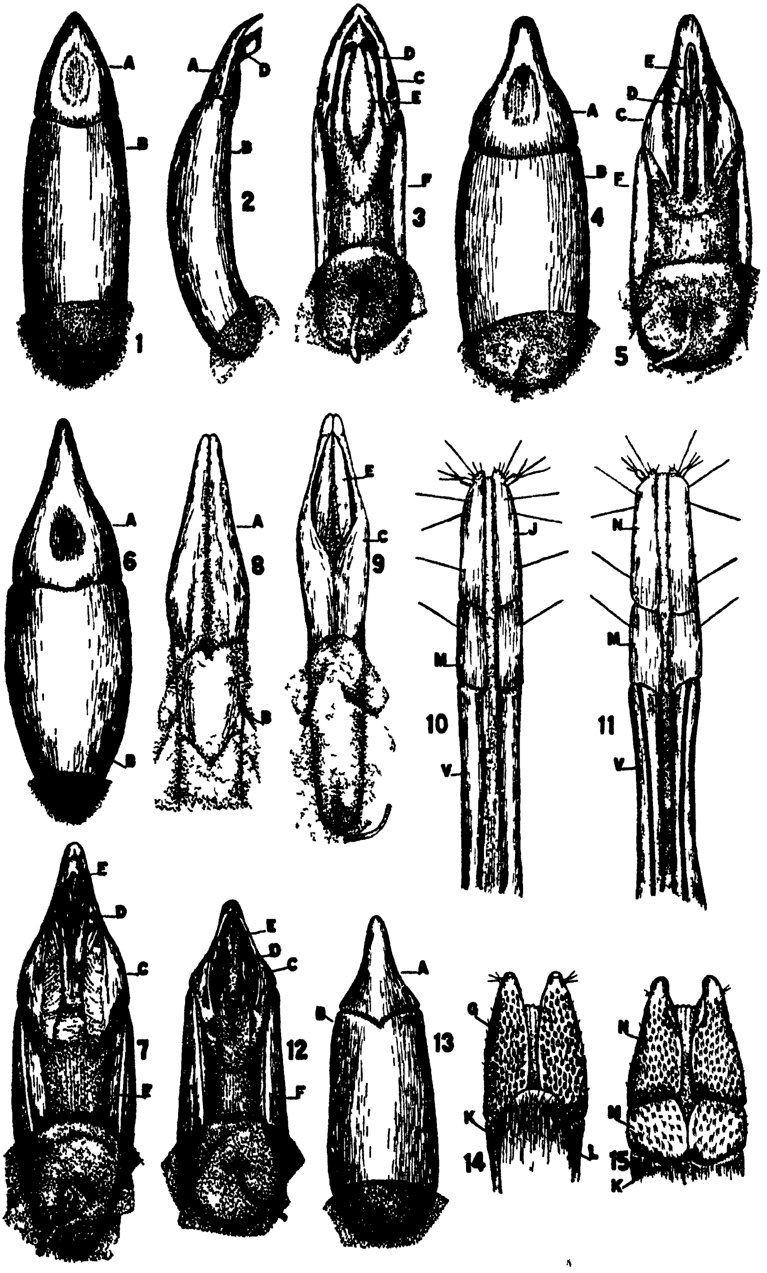
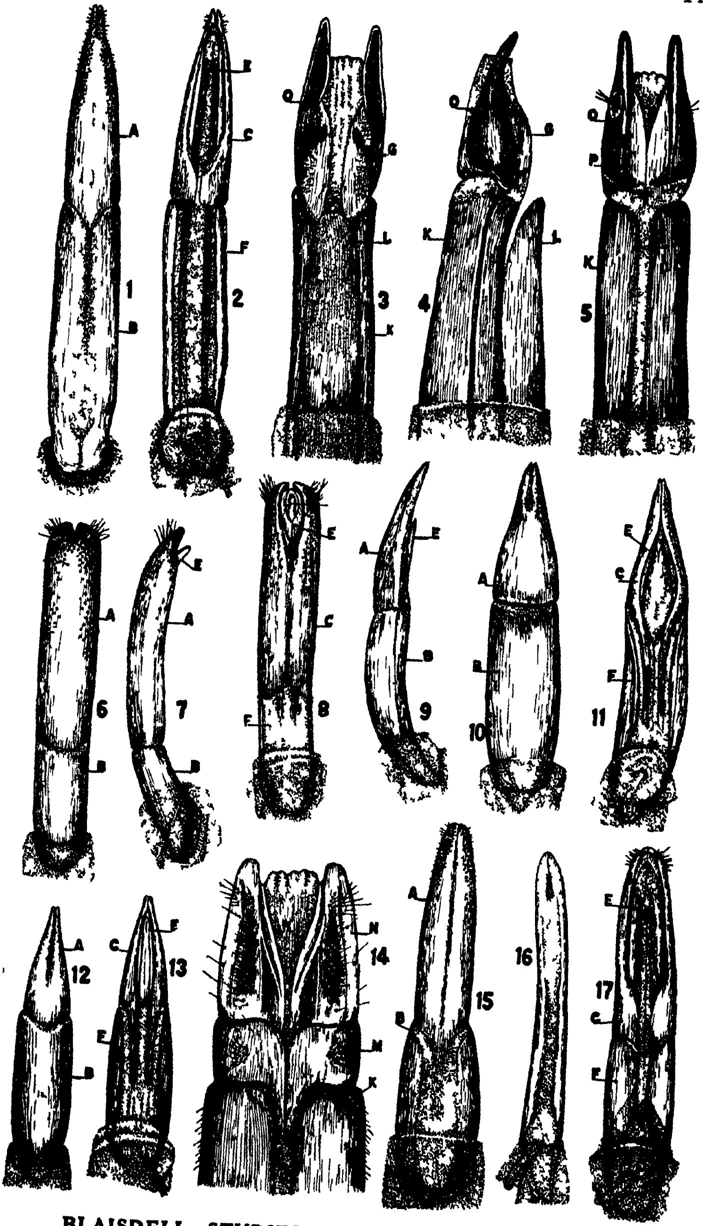
[7] Hans Gebien, Katalog der Tenebrioniden (Coleoptera Heteromera), Teil 1, p. 206, (abgeschlossen August, 1936).

[8] Blaisdell, Trans. Amer. Ent. Soc., LIX, p. 223, (Sept. 21, 1933): (Studies in the Tenebrionidae, No. III.)



BLAISDELL—STUDIES IN THE TENEBRIONIDAE

Pl V.



BLAISDELL—STUDIES IN THE TENEBRIONIDAE

STUDIES OF CERTAIN CYRTACANTHACRIDOID GENERA (ORTHOPTERA: ACRIDIDAE)

PART I.

THE PODISMA COMPLEX

BY JAMES A. G. REHN AND JOHN W. H. REHN

(Plates VI and VII and text-figures)

At the present time no angle of the taxonomy of the Orthoptera is more troublesome, contradictory and less definite than the group assignments of a great number of genera of the Cyrtacanthacridinae. Without even considering the relationship of this section or passing upon its cohesiveness, modern work will become a meaningless jumble unless the various subsidiary entities are carefully examined, redefined and the numerous genera involved assigned to units of higher status which are not merely arbitrary dumping grounds but indicators of natural affinities.

The regional character of most of the systematic studies in Orthoptera has to a considerable degree militated against work of a broad and comprehensive character. Also collections of the type required for this work must be reasonably comprehensive and representative and such unfortunately are few in number.

To-day many genera of this subfamily are being described without the slightest indication of a related genus, a situation probably brought about by the vagueness and shortcomings of much of the older literature. Entirely apart from whether one feels that uncompared genera are validly proposed, this situation retards instead of assists future work by others.

The present series is planned to make available conclusions drawn from comparative studies which throw light on the relationship of the genera discussed, the features of the group or groups of genera involved and the origin and distribution of these groups. Synonymy will be presented where clearly established either by the present work or by the current investigations of other students. New genera and species will be described when and as their appearance seems important in the general plan.

Unless specifically stated otherwise the material discussed in these studies is contained in the collection of the Academy of Natural Sciences of Philadelphia or in the Hebard Collection there deposited.

PART I. THE PODISMA COMPLEX

Several years ago when describing the North American genus *Appalachia* we had occasion to comment upon the then recent study by Dovnar[1] in which a relatively large number of new genera of Old World Podismini were described. We then expressed our regret that no attempt had been made by him to compare with these, or to integrate in the study, the distinctly more numerous New World genera which had been referred to the same group by various authors during the past forty or more years. A number of these New World genera we believed were much more nearly related to those of the Old World than previous work indicated. While at the time of the previous writing we possessed representatives, and usually of the genotypic species, of all but a very limited number of the Old World podismoid genera recognized by Dovnar, Ikonnikov and other authors, as well as of all of the recognized New World genera, we then realized that certain problems involving Old World genera still unavailable to us required solution before substantially constructive conclusions, of broader and more permanent values than those of Dovnar, could be reached.

Through the courteous cooperation of certain of our colleagues, in particular Dr. E. Miram, of the Zoological Museum of the Academy of Sciences of the USSR at Leningrad, we have been permitted to study material of several rare genera (i.e. *Ognevia* and *Plotnikovia*) previously unavailable to us. At the cost of a very considerable amount of her valuable time, Dr. Miram most kindly made excellent drawings from other important podismoid type material contained in the Museum at Leningrad, and has graciously permitted us to reproduce these figures where and as we find this to be desirable. For this unselfish cooperation, quite rare in these days, Dr. Miram has placed us under lasting obligation. Dr. Uvarov, at the British Museum of Natural History, has aided very materially by exchanges which enabled us to add several genera to our representation, including *Kingdonella* and *Indopodisma.*

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[1] Travaux Inst. Zool. Acad. Sci. URSS, I, pp. 253-269, 5 text figs., (1933).

In the Melanopli (Podismini of Old World authors), as understood by Scudder, we have a large widespread aggregation that has usually been recognized as a definite assemblage, but when one attempts to trace the various tendencies, or to differentiate the subsidiary groups of the section, there appears to be an almost complete lack of information. It is clearly evident from the study of related genera that within its vaguely defined limits there are a number of previously unrecognized entities, and it is our intention to study these and to present our conclusions upon their position and relationship in other numbers of this set of studies.

Within the group we have a general reoccurrence of certain basic tendencies, which apparently have been developed independently by the different entities, and as a result it is practically impossible to give comparative diagnoses that will separate these entities from related ones, and at the same time include all the diverse members of any one of them.

While we are not at present in a position to differentiate, what may for convenience be termed, the podismoid assemblage within the Melanopli, we definitely believe that it represents one of the larger subsidiary units. However, within this assemblage there appear to be several diverse lines of specialization which tentatively we are terming complexes. It is fortunate that the oldest generic name within the group, i.e. *Podisma,* is based on a quite generalized and the most typical known member of the assemblage. From this basic type, which probably most closely approaches the ancestral stock, a number of divergent evolutionary lines have developed with the basic forms of these stocks intimately related to *Podisma.*

At this time it is not feasible to treat this whole assemblage, so we have decided to limit the present study to one of these complexes, and it seemed logical to select for the first of this series those genera more closely related to and including *Podisma.* This might well be termed the basic complex of the assemblage, as it includes the generalized genus *Podisma* from which the other groups apparently have been derived.

While the basic members of the other complexes are in almost all cases intimately related to *Podisma,* on the other hand they show certain tendencies that are emphasized or elaborated in the more specialized genera of these units, and as a result certain of these basic genera are exceedingly difficult to place in any arrangement, as practically they might be considered as the connecting links between these respective genera series.

At this time we are not attempting to discuss all of these troublesome annectant genera as they are intimately involved in these other complexes. These will be treated in following parts of the present series.

The Podisma complex, as understood by us, does not include many diverse forms usually placed in the Podismini by previous workers, nor does it include all the Old World representatives of the group Melanopli as has often been intimated by other students, particularly those in the New World, but it does include the five genera most closely related to *Podisma.* These are found in both the Old and New Worlds and give us a Holarctic distribution for the complex.

The oldest generic name in the group is *Podisma* Latreille, 1829, which had two included species, i.e. *pedestris* and *giornae,* the former having since been made the type of the genus, while the latter has similarly been selected as the type of *Pezotettix* Burmeister. Also included in the group are the Old World genera *Eirenephilus* and *Ognevia* of Ikonnikov, and the new genus *Caudellacris,* while the New World representatives include *Dendrotettix* Packard and *Appalachia* Rehn and Rehn.

The Podisma complex has developed along two main branches from the basic *Podisma* stock, one of these lines being through *Eirenephilus* and *Ognevia,* finally terminating in *Caudellacris,* while the other branch contains the two American genera of the complex, with *Dendrotettix* less divergent and terminating in *Appalachia.*

Probable History of the Complex.—It is easy to assume that an Angaran asylum was the center in which developed and from which dispersed the genera, or the ancestors of the genera, of which the present entity is composed. However, this explanation fails to take into account a number of angles of the problem, not only of this complex but of related ones, regarding which more evidence will be presented at a later date. Considered as an individual entity it is apparent that the genera here critically discussed belong to a relatively old phylum; their presence in North America by well differentiated representatives attests their preglacial migrations, while the distribution of their most widely distributed genus (*Podisma*) is clearly a reflection of glacial influences. Similarly the diversity of the representation in unglaciated non-arctic eastern Asia is significant.

We feel that the complex has developed and gone through a considerable part of its differentiation in eastern Asia, i.e. Ussuri, Korea and China at least west to Szechuan. This is the area to which *Ognevia*, *Eirenephilus* and *Caudellacris* are entirely or largely restricted today.[2] At least a large part of this area has clearly been a center of zoological and botanical differentiation, and the relationship of many of its types of comparatively great antiquity with those of unglaciated areas, of relatively similar geological history, in eastern North America is well known to animal and plant geographers.

The genus *Eirenephilus* has all the earmarks of one of relatively ancient character and its broader distribution than *Ognevia* would seem to indicate greater antiquity. Differentiation in the genus *Caudellacris* indicates a unit responsive to influences probably having an orographic background.

The widely distributed genus *Podisma* clearly had a broad preglacial distribution, and its present Old World range represents on one hand isolated relict types stranded on mountain masses

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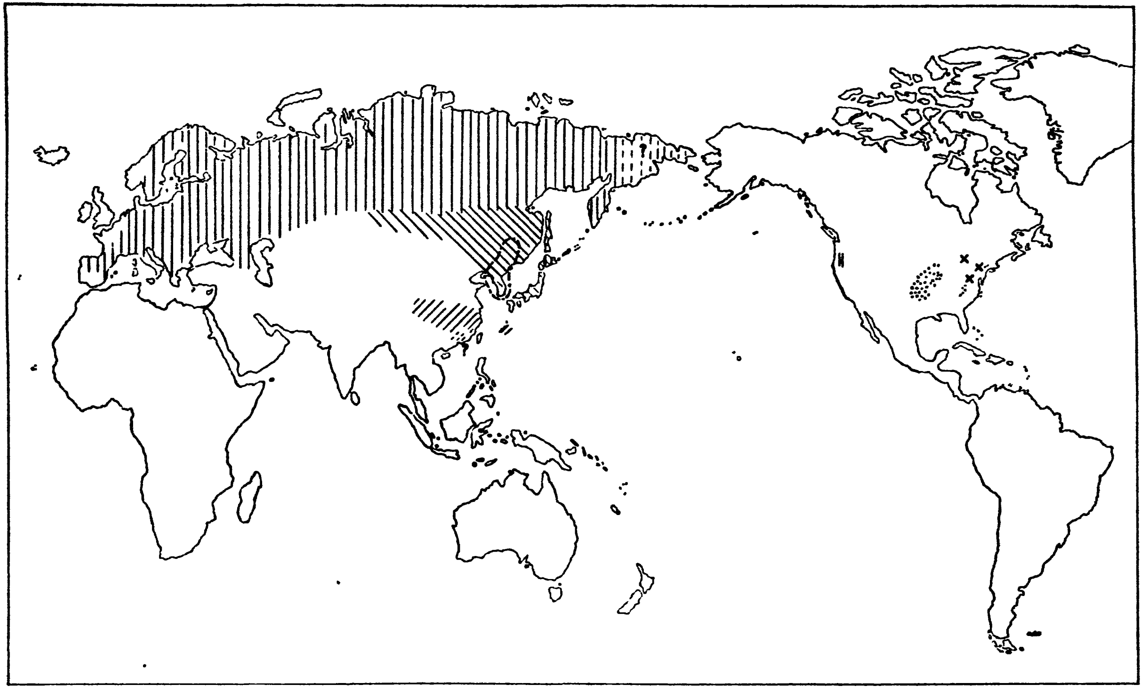
[2] The very interesting map delimiting the zoogeographic subdivisions of the Palearctic Region drawn largely from studies of the Coleoptera, recently published by Semenov Tian-Shansky (Trav Inst. Zool. Acad. Sci. URSS, II, facing p. 410 (1935)) lends support to the hypothesis here expressed, that except for the genus *Podisma* the ranges of all the Old World members of this complex are limited by, or extend but narrowly beyond, the general boundaries of four or so of the provinces of his Palaearchaearctic Subregion.



Distribution of the genera of the *Podisma* complex. Vertical lines show general area over which *Podisma* is locally or more broadly distributed; oblique lines to lower right, approximate range of *Eirenephilus;* oblique line to lower left, area of *Caudellacris;* area enclosed within dot and dash boundary, area of *Ognevia;* dotted area, range of *Dendrotettix;* crosses, areas in which *Appalachia* occurs.

along the southern edge of its European habitat, and on the other a reoccupancy of glaciated country to the northward as the ice withdrew. Its Siberian distribution is clearly in large part over territory which has not been glaciated. The isolation of *P. sapporensis* in Yezo is probably that of a relict type stranded there in glacial times. That this extreme eastern branch of the genus is relatively close to the sole New World representative of the genus would indicate a common preglacial origin, and the presence of *P. hesperus* on the coastal side of the Cascade Mountains in Oregon, an area with many relatively recent Asiatic immigrants, is not difficult to understand in view of the existing shallow water over most of Bering Sea, and the extent to which the locking-up of water in glacial ice and upwarping of the marine bottom may have reduced the Pleistocene oceanic level in that territory,[8] and thus exposed broad areas now submerged. The American branch of the complex which has produced *Dendrotettix* and *Appalachia* clearly is one of the older types of Asiatic invaders of North America, the assemblage to which belong a number of the forest trees, shrubs and animals of eastern North America, the antiquity of which in the New World far antedates the Pleistocene. The differentiation of these two genera probably took place in North America, and under each of these genera we have endeavored to interpet their probable dispersal in late glacial and post-glacial times.

Key to the Genera of the Podisma Complex

1. Males 2
   Females 7
2. Cerci of male either short, sublamellate, twisted distad, or relatively elongate and with apex broadly and unsymmetrically clavate 3
   Cerci of male either short, conically tapering or elongate styliform ..4
3. Cerci of male short, sublamellate, twisted distad; ultimate tergite (supra-anal plate) relatively elongate, subtrapeziform; ultimate sternite (subgenital plate) without a subapical tubercle.
   Dendrotettix Packard
   Cerci of male elongate, with apex broadly and unsymmetrically clavate; ultimate tergite (supra-anal plate) elongate, subtrigonal; ultimate sternite (subgenital plate) with a distinct but low subapical tubercle.
   Caudellacris new genus

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[8] See Smith, Philip S. "Certain Relations between Northwestern America and Northeastern Asia." Pages 85 to 92, plate 6, in "Early Man". Philadelphia, 1938.

4. Ultimate sternite (subgenital plate) with a subapical tubercle; ultimate tergite (supra-anal plate) with at least some indications of paired lamellations near apex; [posterior margin of pronotum either distinctly produced or arcuate] 5

Ultimate sternite (subgenital plate) without a subapical tubercle; ultimate tergite (supra-anal plate) without paired lamellations near apex; [posterior margin of pronotum very broadly arcuate or angulately produced mesad] ....*Appalachia* Rehn and Rehn

5. Cerci of male elongate styliform, as long as or longer than ultimate tergite (supra-anal plate); ultimate sternite (subgenital plate) with a very distinct acute, subapical tubercle ....*Eirenephilus* Ikonnikov

Cerci of male conical or styliform but not as long as ultimate tergite (supra-anal plate); ultimate sternite (subgenital plate) with at most a low-subapical tubercle 6

6. Cerci of male short heavy conical; pronotum with a medio-longitudinal carina on metazona and at least on a portion of prozona; furcula distinct, digitiform; ultimate tergite (supra-anal plate) with margins of distal portion sinuato-convergent, thus producing lateral supplementary obtuse-angulations distinct from the more narrowly angulate median production ....*Podisma* Latreille

Cerci of male elongate styliform; pronotum with a medio-longitudinal carina only on metazona; furcula low rounded lobes; ultimate tergite (supra-anal plate) with margins of distal portion regularly subarcuate convergent ....*Ognevia* Ikonnikov

7. Ultimate sternite (subgenital plate) of female either quinquedentate or quinque-undulate (i.e. a median production with paired lateral teeth and with lateral portions of plate produced).

Caudellacris new genus

Ultimate sternite (subgenital plate) of female not quinquedentate or quinque-undulate, with only a median production 8

8. Dorsal ovipositor valves, in lateral aspect, with dorso-lateral margins definitely sigmoid; in dorsal aspect, with a mesal concavity in distal portion 9

Dorsal ovipositor valves, in lateral aspect, with dorso-lateral margins not definitely sigmoid; in dorsal aspect, without a mesal concavity.

Appalachia Rehn and Rehn

9. Pronotum of female with posterior margin produced obtuse-angulate; medio-longitudinal carina of pronotum present only on metazona ..10

Pronotum of female with posterior margin not produced obtuse-angulate, as a whole arcuate; medio-longitudinal carina of pronotum present on metazona and at least on a portion of prozona 11

10. Prozona of pronotum not inflated; ultimate sternite (subgenital plate) with distal margin as a whole broadly arcuate, with a narrow sublamellar vertical production between valves ..*Eirenephilus* Ikonnikov

Prozona of pronotum subinflated; ultimate sternite (subgenital plate) with a broad acute-angulate median production ..*Ognevia* Ikonnikov

11. Ultimate sternite (subgenital plate) with distal margin obtusely rectangulately produced mesad; prozona of pronotum distinctly longer than metazona; greatest width of head approximately equal to greatest width of metazona ....*Dendrotettix* Packard

Ultimate sternite (subgenital plate) with distal margin acute-angulate produced mesad; prozona and metazona of pronotum approximately subequal in length; greatest width of head appreciably less than greatest width of metazona ....*Podisma* Latreille

CAUDELLACRIS[4] new genus

This striking genus, which is in many ways the most divergent member of the Podisma Complex, is more nearly related to *Ognevia*. From all the other genera of the complex *Caudellacris* is readily separable by having the cerci elongate, with the apex broadly and unsymmetrically clavate in the male, and the ultimate sternite (subgenital plate) of the female with a median and paired lateral productions, while the dorso-lateral angles are somewhat produced, so that the posterior margin of the plate, as a whole, varies from quinque-undulate to quinquedentate. From *Ognevia* the present genus differs by having a somewhat broader head and prominent eyes, in this respect approaching to some extent the megalocephalic condition found in *Dendrotettix*; the frontal costa has its lateral margins, in the ventral portion, more strongly indicated than in *Ognevia*, and more distinctly sulcate ventrad of antennal bases than in the latter, in this respect resembling to a marked degree the condition found in *Eirenephilus;* pronotum with lateral margins practically subparallel as in *Ognevia*, and not divergent posteriorly as are those of the metazona in *Eirenephilus*, but the prozona is not subinflated as is the case in *Ognevia*, or as is at times very faintly indicated in *Eirenephilus*. As in the closely related genera *Eirenephilus* and *Ognevia*, the present genus is known only from macropterous material. The male has a rounded subapical tubercle on the ultimate sternite, this being more prominent than in *Ognevia* but less so than in *Eirenephilus;* the ultimate tergite is as a whole subtrigonal, while in *Ognevia* this plate is rather broad and has the margins of the distal portion subarcuate convergent.

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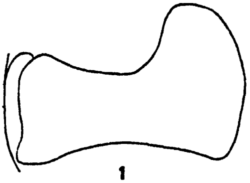
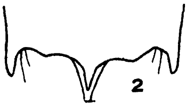
[4] Dedicated to our friend and colleague, the late Andrew Nelson Caudell, Custodian of Orthoptera in the United States National Museum, in appreciation of the cordial cooperation and lovable characteristics which endeared him to all his co-workers.

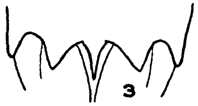
Generic characters.—General form rather large for group, moderately elongate and heavy; head rather prominent, antennae longer than head and pronotum; tegmina and wings well developed; anterior and median legs average; posterior ones rather stocky. Head distinctly broader than long; eyes quite prominent, obovate to subelliptical, globose; interocular area relatively narrow (♀) to decidedly narrowed (♂); fastigium shallowly impressed, lateral margins distinct, in profile declivent. Fastigio-facial angle, in profile, broadly rounded; frontal costa with margins distinct, extending almost to clypeal margin, sulcate below antennal bases. Pronotum with transverse sulci continuously indicated, more strongly developed in male than in female; anterior margin subtruncate, posterior margin varying from broadly and evenly arcuate (in majority of males) to somewhat produced mesad with apex broadly rounded, obtuse-angulate (in most females); medio-longitudinal carina definite on metazona, usually present on most of prozona, but at times lacking before anterior sulcus, or often not definite but indicated by a medio-longitudinal dark stripe; length of metazona varying from subequal with to about two-thirds the length of prozona; surface of metazona irregularly cribroso-punctulate: lateral lobes of pronotum with depth varying from a little more than half to about two-thirds dorsal length; anterior margin subsinuate to subvertical; ventral margin in anterior half obliquely truncate, or very feebly arcuato-concave, posterior half varying from horizontal though subsinuate to obliquely acclivent, posterior margin obliquely ascendant. Tegmina and wings well developed, at least almost reaching genicular area of posterior femora. Prosternal spine pyramidal, erect, apex narrowly rounded, sharper in male than in female. Abdomen with a medio-longitudinal carina. Male with furcula represented by low nodes; ultimate tergite (supra-anal plate) subtrigonal, with a median sulcation in basal third and at least shallowly impressed on apical third, with paired tubercles near distal end, near proximal third of lateral margins a raised point. Cercus of male with apex broadly and unsymmetrically clavate, in general outline resembling a hefted stone celt. Cercus of female short, pyramidâl, apex rounded. Ultimate sternite (subgenital plate) of male with a low, rounded, subapical tubercle; dorsal margin, in lateral view, nearly straight except for subapical tubercle where it is slightly ascendant. Ultimate tergite (supra-anal plate) of female distinctly longer than broad, lateral margins of posterior portion arcuately convergent to rounded apex. Ultimate sternite (subgenital plate) of female with an elongate, acute-angulate median production, with paired lateral productions (the degree of production of these is specifically diagnostic); in lateral aspect the dorso-lateral angles are produced to a varying degree. Ovipositor valves moderately heavy, dorsal ones weakly concave on dorsal surface, with a definite mesal concavity in distal portion, dorso-lateral margins, in lateral aspect, distinctly sinuate, apex acute-angulate, ventral valves concave in distal portion, with an evident external basal tooth. Anterior and median femora rather heavy, those of male subinflated; posterior femora relatively heavy, tapering in distal two-thirds, genicular lobes rounded acute-angulate. Posterior tarsi with third article subequal to first (metatarsus) and second articles.

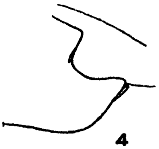
GENOTYPE: *Caudellacris omei* new species.

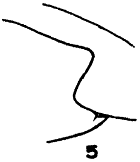
This genus has three known forms, the species here described, *viridifemorata* (Caudell), which is known from the provinces of Hupeh, Kiangsi, Chekiang and Szechuan, China, and *okinawaensis* Shiraki, which is known only from Naha, Okinawa (Loo Choo Islands).











Text-fig 1.—*Caudellacris omei* new species. Male (*paratype*). Mount Omei, Szechuan, China. Outline of cercus. (Greatly enlarged.)

Text-fig. 2.—*Caudellacris viridifemorata* (Caudell). Female (*paratype*). Mokanshan, China. Ventral view of distal margin of ultimate sternite. (Greatly enlarged.)

Text-fig. 3.—*Caudellacris omei* new species. Female (*allotype*). Mount Omei, Szechuan, China. Ventral view of distal margin of ultimate sternite. (Greatly enlarged.)

Text-fig. 4.—*Caudellacris omei* new species. Female (*allotype*). Mount Omei, Szechuan, China. Lateral view of distal margin of ultimate sternite. (Greatly enlarged.)

Text-fig. 5.—*Caudellacris viridifemorata* (Caudell). Female (*paratype*). Mokanshan, China. Lateral view of distal margin of ultimate sternite. (Greatly enlarged.)

Caudellacris omei new species
(Text-figs. 1, 3 and 4; pl. VI, fig. 2, pl. VII, figs. 7, 12 and 13.)

This species is quite closely related to the other definitely known species of the genus, *viridifemorata,* but may be distinguished from it by the slightly larger size, the, as a rule, longer tegmina and wings which usually surpass the posterior femora, the narrower, particularly in the female, interocular area and the more definite margins of this area and of the fastigium. The male of the present form differs from that sex of *viridifemorata* by having the capitate portion of the cercus with the apical margin almost evenly arcuate, its anterior portion more evenly rounded and the postero-apical angle more nearly rectangulate.

In the female sex of *omei* the lateral productions of the ultimate sternite (subgenital plate) are acute-angulate and at least as long as the median production, while in *viridifemorata* these are weakly indicated by obtuse-angulate productions which are considerably shorter than the median one, moreover, the lateral production of this sternite is more definitely rectangulate in *omei* than in *viridifemorata.*

Type.—♂; Mount Omei, Szechuan, China. Elevation, 2500 feet. August 2, 1929. [Hebard Collection, Type no. 1348].

Size rather large for group,[5] about the same as *viridifemorata.*

Head quite large; greatest width of genae contained about one and one-third times in greatest depth of head; greatest width of fastigium equal to one and one-third times the greatest length of same anterior of least interocular space, lateral margins obliquely convergent to anterior subtruncate one, which is equal to half of greatest width, disk shallowly excavate, its margins distinct; in lateral aspect the fastigium is declivent, fastigio-facial angle in profile broadly rounded, obtuse-angulate, face obliquely receding; frontal costa with its margins definite, subparallel, shallowly sulcate from inter-antennal region to near clypeal margin, at latter subdeplanate. Eyes large, globose, in profile ovate, slightly wider than long. Antennae elongate, reaching to proximal abdominal segment, elongate, filiform, composed of twenty-four or twenty-five articles.

Pronotum subrectangulate in general form, greatest width of disk equal to approximately three-fourths of greatest length; anterior margin as a whole weakly arcuate, with a slight median emargination, posterior margin slightly produced, rounded obtuse-angulate; medio-longitudinal carina weakly indicated on prozona, more definite on metazona; transverse sulci definite, distinctly cutting the medio-longitudinal carina, primary sulcus very slightly behind middle; disk of prozona relatively smooth, that of metazona cribroso-punctate; lateral lobes distinctly longitudinal, anterior margin weakly arcuate, ventro-anterior angle broadly rounded, anterior half of ventral margin obliquely subtruncate, posterior half subhorizontal, straight, posterior margin obliquely ascendant.

Tegmina elongate, slightly surpassing genicular area of posterior femora and not quite attaining apex of abdomen; costal margin, particularly near base, subcoriaceous; anal area in basal portion cribroso-areolate, apically subreticulate.

Abdomen subcircular in section, apical tergites with a low medio-longitudinal carina on their posterior third: furcula quite low, rounded, separated by a relatively narrow interspace. Ultimate tergite (supra-anal plate) as a whole trigonal with its median length approximately equal to its proximal width: medio-longitudinal sulcus very distinct proximad, its margins obliquely convergent to three-fifths the length of tergite, where sulcus is interrupted, from there to apex these margins are slightly divergent; proximad with lateral sublongitudinal elongate ridges; in apical fifth with a pair of distinct rounded nodes or slightly elongate ridges which flank the margins of the sulcus; lateral margins of tergite lowly and arcuately convergent to the broadly and evenly obtuse-angulate rounded apex. Cerci relatively elongate, with apex broadly and unsymmetrically clavate, shaft relatively broad, entire posterior margin weakly and evenly concave, anterior margin in basal two-thirds rather strongly concave, apical margin evenly and weakly arcuate, anterior margin in apical third lobate produced, giving an unsymmetrically clavate apex, postero-apical angle almost rectangulate. Ultimate sternite (subgenital plate) in lateral view with dorsal margin nearly straight, ventral outline sinuate, apically produced into a rounded trigonal subapical tubercle, in dorsal aspect with lateral margins arcuate, apical margin strongly and roundly produced mesad, not cutting subapical tubercle.

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[5] The features given in the generic description have been repeated here only when elaboration is necessary.

Prosternal spine suberect, conical, posterior face declivent, immediate apex rounded. Mesosternal interspace subquadrate, greatest width less than width of mesosternal lobes; metasternal interspace narrow pyriform.

Anterior and median limbs quite short, relatively heavy; posterior femora reaching almost to apex of tegmina, relatively stout, greatest depth contained slightly more than three times in greatest length, gradually narrowing from point of greatest width to pregenicular constriction, the depth of which is equal to about half the greatest width; pattern of pagina regular and rather deeply impressed; genicular lobes with ventral margin sinuate, distal margin broadly rounded: posterior tibiae with ten spines on external margin.

Allotype.—♀; Same locality and elevation as type. August 15, 1929. [Hebard Collection].

Differing from the male solely in the following noteworthy features.

General size larger and more robust.

Head with fastigium slightly broader, face less receding; anterior margin of pronotal disk weakly arcuate, not emarginate mesad, posterior margin as a whole rounded, but feebly subtruncate mesad; transverse sulci less definite.

Abdomen slightly compressed, tergites with a medio-longitudinal carina. Ultimate tergite (supra-anal plate) broadly trigonal, greatest length slightly more than greatest width, lateral margins obliquely convergent, apex broadly rounded. Cerci relatively short and quite heavy, conical. Ultimate sternite (subgenital plate) with distal margin quiquedentate, a definite narrow median tooth between the bases of ventral ovipositor valves, flanked by two large, lateral teeth that are longer than the median one, immediate apices of these acute-angulate, lateral production of ultimate sternite definitely produced, almost as long as lateral teeth of ventral margin, their apices subrectangulate.

Anterior and median limbs more elongate and more slender, posterior tibiae with nine or ten spines on external margin.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of pronotal disk	Length of tegmen	Length of posterior femur
♂, Mt. Omei, Szechuan, *type*	26	5.1	3.5	18.2	12.5
♂, Mt. Omei, Szechuan, *paratypes* (extremes)	24.5-27	4.8-5.1	3.2-3 5	16.8-18.8	11.5-12.8
♀, Mt. Omei, Szechuan, *allotype*	34	7	4.8	24.2	16
♀, Mt. Omei, Szechuan, *paratypes* (extremes)	28-36	6-7	4 5-5	20.8-24.5	15.2-16.2
♀, Kwanshien, Szechuan, (extremes)	28-34.8	6.2-7	4.8-5	22.2-24	15.2-16

Coloration. General color of body of male olive-ocher but with the following black markings; a post-ocular bar, bar along dorso-lateral margins of pronotum, a thin medio-longitudinal stripe on pronotum, meso- and metapleural sclerites mostly bordered with black, penultimate and antepenultimate abdominal tergites posteriorly bordered with black, ultimate tergite, except for longitudinal carinae, black, distal portion of ultimate sternite and apex of cercus dark fuscous to black. Disk of pronotum buffy-olive, antennae light fuscous, eyes brick red to burnt umber, tegmina snuff brown with veins lighter brown. Anterior limbs olive-ocher, median ones slightly more greenish, posterior femora with two black dorsal bars, genicular area black, external face light yellow or dull greenish varying to dull fuscous, posterior tibiae dull glaucous except for light basal band, all tarsi relatively light, most articles margined with dark, arolia usually fuscous, claws black.

Color of female essentially like that of male except as follows: abdomen fuscous; ovipositor valves brownish usually margined with black, apices black; lateral teeth of disto-ventral margin of ultimate sternite usually black.

Specimens examined.—44; 9♂, 35♀.

China: Szechuan; Mount Omei; elevation 2500-4500 feet,[6] August 2-31, 1929; 9♂, 32♀; (type, allotype, paratype); [Hebard Cln. and A.N.S.P.]: Kwanshien; elevation 2800-3000 ft.[6] July 22-August 14, 1930; 3♀; [Hebard Cln. and A.N.S.P.].

Caudellacris viridifemorata (Caudell) (Text-figs. 2 and 5.)

1921. *Catantops viridifemoratus* Caudell, Proc. Entom. Soc. Wash., XXIII, p. 32, fig. 2. [♂, ♀; Mokanshan [Chekiang Province], China.]

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[6] Some of the material before us does not have elevation given.

1929. *Podisma viridifemorata* Tsai, Journ. Coll. Agric. Imp. Univ. Tokyo, x, p. 143, text-figs. 3a-3g. [♂, ♀; "South China (probably at Canton)."] (Independent description.)
1936. *Melanoplus viridifemoratus* Tinkham, Lingnan Sci. Journ., xv, p. 211. (Synonymy and generic reference.)

Tinkham correctly established the synonymy of Tsai's independently proposed *Podisma viridifemorata* under Caudell's older specific name, and expressed the surprise which is natural to anyone, as the context of Tsai's study makes evident his knowledge of Caudell's paper, and that author's *Catantops viridifemoratus* is there listed by Tsai among the known Chinese acridids.

We have before us in the Hebard Collection a paratypic female of *Catantops viridifemoratus,* received in exchange from the United States National Museum, and in the Academy series several other individuals (representing both sexes) from or near Tien-mu-shan, Chekiang Province, China, determined as this species and presented by Mr. Chang. These evidently formed a part of the series from that locality of which Tinkham (vide supra) has recorded representatives.

Caudellacris okinawaensis (Shiraki)

1930. *Melanoplus okinawaensis* Shiraki, Trans. Nat. Hist. Soc. Formosa, xx, pp. 330-332. [♀; Naha, Okinawa.]
1936. *Melanoplus okinawaensis* Tinkham, Lingman, Sci. Journ., xv, p. 211.
1936. *Melanoplus okinawaensis* Tinkham, Lingnan, Sci. Journ., xv, p. 405.

We have not seen this form of the genus and can only refer it to this genus as a result of Tinkham's comments on Shiraki's type, made in re *viridifemorata,* to which, according to Tinkham, *okinawaensis* is very closely related.

The following notes drawn from a study of the description seem to show some slight differences from the condition found in *viridifemorata*; the frontal costa is distinctly sulcate but in *viridifemorata* it is only so ventrad of the inter-antennal region, the pronotal surface is evidently rougher, and it apparently lacks a medio-longitudinal carina on the prozona, also the ventral margin of the lateral lobes of the pronotum is said to be horizontal and the mesosternal lobes distinctly longer than broad. This combination of characters appears to separate this form, which as yet is known only from the female sex.

OGNEVIA Ikonnikov

1912. *Ognevia* Ikonnikov, Ann. Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, XVI, pp. 267, 268.

1913. *Ognevia* Ikonnikov, Über die von P. Schmidt aus Korea mitgebrachten Acridioideen, Kusnetzk, p. 20.

1933. *Ognevia* Dovnar, Travaux Inst. Zool. Acad. Sci. URSS, I, pp. 257, 262, 264.

GENOTYPE (by monotypy): *Ognevia sergii* Ikonnikov.

This interesting and little-known genus is in many respects very closely related to both *Eirenephilus* and *Podisma,* but like the former, is known solely from the macropterous condition. The head of *Ognevia* is rather large, resembling that of *Caudellacris,* but the vertex is more shallowly excavate than in the latter, and the margins of the vertex are not as distinct as in that genus; in both of these features *Ognevia* resembles the condition found in *Podisma* and *Eirenephilus.* The frontal costa in *Ognevia* has the margins more or less parallel, relatively distinct and continuing to the clypeal margin, moreover the enclosed area between the antennal bases is weakly sulcate while near the clypeal margin it is deplanate, these features resembling the condition found in *Caudellacris* and *Eirenephilus,* while the fastigio-facial angle is broadly and lowly rounded, much as in *Podisma.* The eyes, while in their actual dimensions quite small for the group, are globose and more subcircular than in the related genera.

The pronotum of the male is much as in *Caudellacris* except that the medio-longitudinal carina is present only on the metazona, the prozona is subinflated, the posterior margin of the disk is somewhat produced obtuse-angulate, as in *Eirenephilus,* and the humeral shoulders are rounded but more definite than in *Caudellacris.* The female sex of *Ognevia* has the pronotum rather large and essentially like that of the male except that the metazona gradually broadens posteriorly, and the transverse carinae are not as strong and evident on the disk of the pronotum as in the opposite sex, moreover, the posterior margin is more obtuse-angulate produced than in the male, and the humeral shoulders are less definite.

The prosternal spine is suberect, conical and with the posterior face slightly obliquely declivous, while the immediate apex is rounded acute.

The peculiar anal field of the tegmina is basally finely and rather obscurely cribroso-areolate, passing medianly and apically into a much more open and irregular suboblique areolation, the whole field with a fairly definite sublongitudinal axillary vein, thus showing on one hand affinity with *Caudellacris* and on the other with *Eirenephilus.*

The anterior and median femora of *Ognevia* are quite robust, and slightly incrassate, being proportionately heavier than in related genera. The posterior femora of the male of this genus are essentially like those of *Eirenephilus* except that they are slightly heavier, while those of the female sex are proportionately more slender than are those of that sex of *Eirenephilus.*

The apex of the abdomen of the male of this interesting genus shows numerous similarities in its structures to those of *Podisma,* but the following differential features will readily separate *Ognevia* from that genus; the furcula are represented by rounded lobes instead of distinctly digitiform processes, the ultimate tergite has the margins of the distal portion subarcuate convergent, and the cerci are elongate styliform, the latter more as in *Eirenephilus* but not as long as in that genus. The ultimate sternite (subgenital plate) of the female has the median production broadly acute-angulate, and the cerci are tapered conical.

This genus with its two species is known from the Siberian province of Ussuri and Korea.

Ognevia sergii Ikonnikov
(Pl. VI, figs. 1, 4 and 5; pl. VII, figs. 8, 11 and 14.)

1912. *Ognevia sergii* Ikonnikov, Ann. Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, xvi, pp. 268, 269, pl. 5, fig. 7. [♀; Evsejevka (44° 30′ N., 133° E.), Ussuri, Siberia.]

1933. *Ognevia sergii* Dovnar, Travaux Inst. Zool. Acad. Sci. URSS, I, p. 264.

This, the genotypic species, was based on the female sex, and in 1913 Ikonnikov[7] described a male from Korea which he considered to be the opposite sex of *sergii*. However, as we are here pointing out, this male represented another species which is known only from that original material.

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[7] Über die von P. Schmidt aus Korea mitgebrachten Acridioideen, Kusnetzk, p. 20.

The male of *sergii* may be separated from that sex of *ikonnikovi*, here described, by having the apex of the ultimate sternite broadly rounded instead of subacuminate, the median sulcus is solely in the basal portion of the ultimate tergite, and the furcula are represented only by low lobes not far apart, instead of being large and relatively distant ones.

The female sex of *ikonnikovi* is as yet unknown, so that no comparison with it is possible.

However, the following information on the female sex of *sergii*, supplementary to the original description of that species, drawn from material before us, may be of some value to future workers in this group.

Ultimate tergite trigonal, about as long as broad, apex rounded acute-angulate. Cerci relatively short, conical. Dorsal ovipositor valves rather short and quite heavy, when viewed from the dorsum with a decided mesad concavity in apical third, dorsolateral margins weakly sigmoid, supplied with irregular low serrations or crenations which average slightly larger proximad, immediate apex of valves in lateral aspect acute-angulate, in dorsal aspect narrowly rounded: ventral ovipositor valves relatively slender, apex narrowly rounded. Ultimate sternite with a quite broad, acute-angulate median production.

Allotype.—♂; Novowladimirov, Ussuri Province, U.S.S.R. August 15, 1910. (Tskersky & Berger). [Zoological Museum, Leningrad].

General form and structure quite similar to that of female except as follows: size somewhat smaller and proportionately more slender; all femora shorter and heavier, anterior and median ones slightly incrassate; frontal costa more weakly sulcate dorsally; pronotum with humeral shoulders more definite, transverse sulci much more definite and quite prominent, posterior margin of pronotum less produced; furcula represented by two small rounded lobes; ultimate tergite as whole pentagonal, apex rounded subrectangulate, proximad with a shallow median sulcus, laterad with rather prominent shoulders, posteriorly with paired low longitudinal ridges; cerci relatively elongate; ultimate sternite with dorsal margin in lateral aspect almost straight oblique, apex, which has a low broadly rounded subapical tubercle, broadly rounded.

Coloration essentially as in female except that the dorsum of the abdomen is darker.

Length of body, 24.5 mm.; length of pronotum, 5.2; length of tegmen, 19; length of posterior femur, 12.2.

This form is known only from Ussuri Province.

Material examined: 3; 1 ♂, 2 ♀.

SOVIET UNION; USSURI PROVINCE: Evgenevka,[8] region of Spaskava; VIII, 16-17, 1910; (Tskersky & Berger); 2 ♀; [Zoolog. Mus. Leningrad]:[9] Novowladimirov; VIII, 15, 1910; (Tskersky & Berger); 1 ♂ (allotype); [Zoolog. Mus. Leningrad].[9]

Ognevia ikonnikovi new species

1913. *Ognevia sergii* Ikonnikov, Über die von P. Schmidt aus Korea mitgebrachten Acridiodeen, Kusnetzk, p. 20. [♂; Monast. Olchons, Korea, Type no. 3313, Collection Ikonnikov.]

This species is known only from the male sex, which was described as the allotype of *O. sergii*, but which, as material of the latter at hand shows, really represents a distinct species.

As we have not seen any material of this species we can merely give the following comparison, drawn from Ikonnikov's description, with the male sex of *sergii*. The apex of the ultimate sternite is subacuminate, not rounded, and the margins near the apex are sinuate, the ultimate tergite is pentagonal with a median sulcus, and the furcula are represented by two large lobes which are somewhat distant.

The present form is known only from the type locality—Monastery Olchons,[10] Korea.

EIRENEPHILUS Ikonnikov

1912. *Eirenephilus* Ikonnikov, Ann. Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, XVI, pp. 264, 265.

1933. *Eirenephilus* Dovnar, Travaux Inst. Zool. Acad. Sci. URSS, I, pp. 256, 261, 263.

GENOTYPE (by monotypy): *Eirenephilus debilis* Ikonnikov.

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[8] It is not possible to ascertain whether or not this is a variant in spelling of Evsejevka; however, if such is the case then these specimens would be topotypes.

[9] All of this material was determined by E. Miram.

[10] It has been impossible to find on any of the available atlases or maps even the approximate position of this or any of the adjacent collecting localities mentioned by Ikonnikov in his report on the Korean acridids collected by Schmidt.

This genus is related to *Podisma* on one hand and to *Ognevia* on the other, and like the latter is known only in the macropterous condition. The general form of the male is relatively slender, while the female is somewhat heavier. The male has the fastigium somewhat compressed, its margins are quite definite and the enclosed area is shallowly concave, resembling to some degree the more shallowly excavate condition found in *Podisma*. The fastigium, in lateral aspect, is obliquely declivous, and the fastigio-facial angle quite prominent, being broadly rounded, subrectangulate, in this respect resembling that of the male of *Ognevia* but more prominent than in the latter genus.

The female of *Eirenephilus* has the fastigium quite broad, without definite margins, and the enclosed area is subdeplanate, thus resembling the condition found in *Ognevia*. The fastigium of the female is essentially like that of the male, except that it is much less produced, more broadly rounded, and lacks definite margins, thus resembling the female of *Ognevia*. In both sexes the frontal costa has the margins definite and the enclosed area is weakly sulcate below the antennal bases, being comparable in part to the condition found in *Ognevia* and in part to that seen in *Caudellacris*.

The pronotum in both sexes is subrectangulate, the mediolongitudinal carina is definite on the metazona and practically lacking on the prozona; the general pronotal form is essentially as in *Ognevia* but differs from that genus by not having the prozona subinflated. The transverse sulci of the pronotum are more definite in the male than in the female, much as in *Ognevia*, but the lateral angles of the metazona are quite definite and broadly rounded.

The posterior femora of the male of *Eirenephilus* are essentially like those of *Ognevia* except that they are more slender, while in the female they are slightly heavier than those of the female of the latter genus.

The apex of the abdomen of the male is characteristic, as the very distinct, acute, subapical tubercle on the ultimate sternite will separate the forms of this genus from any of the other members of the immediate complex. Also the very elongate styliform cerci, which are at least as long as the ultimate tergite, are diagnostic of the genus, although they do resemble, to a marked degree, the type found in *Ognevia*. The more or less pentagonal shape of the ultimate tergite, with its sublinguiform meso-posterior lobe, is distinctive of the genus.

The females of *Eirenephilus* have elongate styliform cerci, these being longer than in the same sex of any of the related genera, and the ultimate sternite has the distal margin, as a whole, broadly arcuate; also there is a narrow, sublamellar vertical production between the base of the lower valves, this being a combination of conditions not found in any of the other genera of the complex.

This genus has a relatively wide distribution being known to occur from the Altai to the Russian Far East, North Mongolia, Manchuria, Korea, Sakhalin, and Yezo and Hondo, Japan.

With the limited material before us we are not able to ascertain whether there is but one quite variable species or two or three forms in this genus. As a result we feel that for the time being it is best to treat all of the involved names as distinct forms.

Eirenephilus debilis Ikonnikov

1912. *Eirenephilus debilis* Ikonnikov, Ann. Mus. Zool. Acad. Imp. Sci. St. Pétersbourg, XVI, p. 265-267. [♂, ♀; Minussink [Upper Yenisei], Evsejevka [Ussuri], Kamen-Rybolov [on Lake Khanka, Ussuri], Village of Uss on Yenisei, Urkan River [Russian Far East].]

1930. *Eirenephilus debilis* Bey-Bienko,[11] Ann. Mag. Nat. Hist. (10), v, p. 499.

1933. *Eirenephilus debilis* Dovnar, Travaux Inst. Zool. Acad. Sci. URSS, I, p. 263, fig. 1.

The males of this form seen by us have more prominent eyes than in *longipennis*, and these, as seen in anterior aspect, are more strongly inflated.

There does not seem to be any appreciable difference between the females of this and of related forms.

Specimens examined.—11; 4♂, 7♀.

SOVIET UNION: EAST SIBERIA;[12] Stretensk District, Transbaikalia; (V. M.

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[11] In this paper Bey-Bienko has summarized much of the information on the distribution of this species.

[12] We also have in addition one male and one female from this general area. This material is labelled in Russian, and after transliteration we are unable, after the study of numerous charts and atlases, to find any locality by the same name. This material has been determined by Miram.

Englehardt); August 14, 1925; 1♂, 1♀; [A.N.S.P. and Hebard Cln.[13]].

SOVIET UNION: USSURI; vicinity of Kartun, Vladivostok district; August, 1927; 3♀; [Hebard Cln. and A.N.S.P.[14]].

MANCHURIA: Gaolindzsy; (P. A. Pavlov); September 13-14, 1927; 1♂, 1♀; [Hebard Cln. and A.N.S.P.[15]].

Eirenephilus longipennis (Shiraki)

1910. *Podisma sapporense* var. *longipennis* Shiraki, Acrididen Japans, Yokohama, p. 77. [Sex not stated; Hagi, Nagato, Hondo, and Sapporo, Yezo, Japan.]

1924. *Podisma longipennis* Hebard, Trans. Amer. Ent. Soc., L, p. 220.

The males of this form have less prominent eyes than in *debilis* and the eyes are less inflated and less elevated when seen in anterior aspect.

The females of this form show no appreciable differences from those of *debilis*.

Specimens examined.—8; 3♂, 5♀.

JAPAN: HONDO: Nishigo, Uzen; 2♂, 1♀; [Hebard Cln. and A N.S.P.]:[16] Along Nakasendo road, between Kyoto and Nikko; (Dr. H. C. Wood); 1♂, 2♀; [A.N.S.P.]:[16] Yamanaka Lake; (C. E. McClung); September 1, 1933; 1♂; [A.N.S.P.].

JAPAN: YEZO: Sapporo; (M. Matsumura); December, 1896; 1♀; [Hebard Cln.].[16]

Eirenephilus niphonus (Furukawa)

1929 (?). *Podisma alpina* subsp. *niphona* Furukawa,[17] pp. 171, 176-177, pl. 5. [♂, ♀; Amur (?), Sagkalien, Hokkaido, North Hondo, Korea.]

It seems quite probable that this will prove to be a synonym of one of the other forms of this genus, perhaps based on material of both, from the localities given.

We can give no information supplementary to the original description, which makes no mention of or comparison with either Ikonnikov's or Shiraki's species.

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[13] This material has been determined by Uvarov.

[14] This material has been determined by Bey-Bienko.

[15] This material was determined by Bey-Bienko, and evidently forms part of the series recorded by him (Ann. Mag. Nat. Hist., (10), v, p. 499, (1930).

[16] This material was recorded by Hebard in his study of Japanese Acrididae, 1924.

[17] We have before us a separate of this paper, but as all important serial data is in Japanese, and in consequence we are not able to tell what serial it is from, although apparently it is in volume 5, published presumably in 1929.

PODISMA Latreille

1829. *Podisma* Latreille, in Cuvier, Regne Anim., 2 ed., v, p. 188.
1840. *Pezotettix* Burmeister, in Germar, Zeitschr. Entom., II, p. 51. (In part, only.)

GENOTYPE (by selection of Westwood, 1840):[18] *Gryllus pedestris* Linnaeus [=*Podisma pedestris* (Linnaeus)].

Of the very considerable number of species which have been referred to the genus *Podisma* by various authors, a large portion have already been removed by Dovnar.[19] It is clearly evident on even casual study that this course was warranted and necessary, although some of Dovnar's placings were made without sufficient consideration, and the whole contribution lacks the constructive thought that it requires, as the present authors have already stated.[20]

Of those which were retained in restricted *Podisma* by Dovnar, or which in the absence of any specific action by him or others remain associated with the generic name *Podisma,* or which study at this time shows must be so associated, from the evidence of material now before us we can place at least six species definitely in this generic assemblage. Of the other species which in recent years have been associated with *Podisma,* in all probability *silvestrii*[21] and *caprai*[22] Salfi are members of *Podisma* as here understood, and the same is very probably true of *satunini* Uvarov[23] and possibly of *rufipes* Fischer de Waldheim.[24] Clearly *parnassica* Scudder[25] is not a true *Podisma,* and this is very probably the case with *syriaca* Brunner.[26] Kuthy's *almasyi*[27] is now known to be a synonym of *Conophyma semenovi* Zubovsky.[28]

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[18] Introd. Mod. Class. Ins, II, p. 45. This fixation, on the same species, is many years prior to that of Scudder (Psyche, VII, p. 296, (1895)).

[19] "Zur Kenntnis der palaarktischen Podismini". Travaux Inst. Zool. Acad. Sci. URSS, I, pp. 253-268, 5 text-figs., (1933).

[20] Trans. Amer. Entom. Soc., LXII, pp. 2-4, (1936).

[21] *Podisma silvestri* Salfi, Bollett. Lab. Zool. Gen. Agraria, Portici, XXVIII, p. 217, figs. 3 a-h, (1935). [♂, ♀; "Bolognola (Etre)."]

[22] *Podisma caprai* Salfi, Bollett. Lab. Zool. Gen. Agraria, Portici, XXVIII, p. 221, figs. 4 a-f. [♂, ♀; Biella, Finestrian Alps, Piedmonte, Italy.]

[23] *Podisma satunini* Uvarov, Bull. Mus. du Caucase, X, p. 46, (1916). [♂, ♀; Sankara Ridge, Abkhasia, 9500 feet, Caucasus; Kamkaska, Sukhum district, Caucasus; Michailovka, Sukhum district, Caucasus.]

[24] *Podisma rufipes* Fischer de Waldheim, Entomogr. de la Russie, IV, p. 249, (1846). [♂; Kasbek, Caucasus.]

[25] *Podisma parnassica* Scudder, Proc. U.S. Nat. Mus., XX, pp. 111, 113, pl. VIII, fig. 3, (1897). [♂, ♀; Mount Parnassus, Greece.]

We are here briefly treating the species examined, listing the material seen with the pertinent data, and giving critical comments bearing upon the systematics, binomics or possible origin of the genus.

As the first named, longest known and most widely distributed of the generic entities which make up not only the *Podisma* complex but the entire group of genera of which it is a member, as well as the one which specifically or by inference is usually assumed to be primitive, the present genus is of particular phylogenetic and zoogeographic interest. These angles have already been discussed on a preceding page as far as they bear upon the broader problem.

Within the genus itself it would appear that a preglacial or early interglacial spread had extended *Podisma* over much of the northern Old World. This we feel was more likely preglacial, and that the extension into extreme western North America, here shown, was later and probably interglacial. The recurrent glacial periods drove the widely extended western wing of the genus into retreats to the southward, where colonies were established, these now isolated and detached forms, while the apparently more mobile *pedestris* repossessed territory exposed by the retreating ice, possibly occupying and abandoning it more than once in the alternation of interglacial and glacial periods.

The occurrence in *Podisma pedestris* of a fully macropterous phase, essentially similar in its morphological characteristics to that which is found in the related North American genus *Dendrotettix*, is of more than passing interest. Our information on the binomics of *pedestris* is less extensive than that on those of *Dendrotettix quercus*, but the future may show the macropterous phase of the former holds an analogous position in the species' economy to that apparently occupied by the same phase of *D. quercus.*[29]

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[26] *Pezotettix syriaca* Brunner, Verhandl. k.-k. zool-bot. Gesell. Wien, XI, p. 225, (1861). [♂; Beirut, Syria.]

[27] *Podisma almasyi* Kuthy, Ann. Mus. Nat. Hungarici, III, p. 218, (1904). [♂, ♀; Karkara, Przevalsk, Karakol-bash, between Ottuk-tash and Küljü-su, Ara-bel, Ar-Tshaly, Karagaiti and Kokdshajak, Tien-Shan, Central Asia.]

[28] According to Uvarov, 1927, Acrididae of Central Asia, p. 182.

Podisma pedestris (Linnaeus)

1758. [*Gryllus* (*Locusta*)] *pedestris* Linnaeus, Syst. Nat., 10 ed., I, p. 433. [Europe.]

All of the material here listed as examined belongs to the more frequent brachypterous phase except the three individuals (2 ♂, 1 ♀) from Government Tobolsk, Siberia, which are all fully macropterous, and for the opportunity to examine which we are largely indebted to Dr. Miram.

We would call attention to the fact that Salfi has erred in figuring the lateral outline of the female ultimate sternite in this species,[30] as in no individual of that sex of the species which we have seen is this other than distinctly sigmoid, as is also true of *carpetana, emiliae* and *uvarovi.*

We have not seen representatives of Dovnar's subspecies *sviridenkoi.*[31]

The range of this species is quite extensive and the localities cited below do not necessarily cover the whole distribution, but list only those represented in available material.

Specimens examined.—52; 26 ♂, 25 ♀, 1 juv. ♀.

SWEDEN: Ljungh; 1 ♂; [Hebard Cln].

GERMANY: Konigssee, Berchtesgaden, Bavaria; VII, 18, 1922; 1 ♂; [Hebard Cln.].

FRANCE: Champagne, Ain; VIII, 16, 1906; (M. Hebard); 1 ♀; [Hebard Cln.]. Evires, Haute Savoie; VIII, 15, 1906; (M. Hebard); 1 ♀; [Hebard Cln.].

SWITZERLAND: Valley on Vouvry, French-Swiss border, Valais; VII, 26; 1 ♂; [A.N.S.P.].[32] Dent de Morcles, Bernese Alps; 1 ♂, 1 ♀; [A.N S.P.].[32] St. Nikolaus, Visp Valley, Pennine Alps, 3708 feet; VIII, 19, 1908; (M. Hebard); 1 ♂; [Hebard Cln.].[33] Schwellenhöhe, Bernese Oberland, 5000-

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[29] See the present authors, "The Post-Oak Locust (*Dendrotettix quercus*) in the Eastern United States, with Notes on Macropterism in the Species (Orthoptera: Acrididae)." *Trans. Amer. Entom. Soc.*, LXIV, pp. 79-95, pls. 5 & 6, (1938).

[30] Bollett. Lab. Zool. Gener. Agrar. Portici, XXVIII, p. 212, fig. 1e, (1935).

[31] Bull. No. Caucasian Plant Protection Station, no. 3, p. 195, (1927). [♂, ♀; Teberda, Mt. Elbruz region, Caucasus.]

[32] Received from and determined by Henri de Saussure.

6000 feet; VIII, 12, 1906; 7♂, 3♀, 1 juv. ♀; [Hebard Cln. and A.N.S.P.].[33] Wengernalp, foot of Jungfrau, Bernese Oberland; VIII, 12, 1906; 2♂; [Hebard Cln.].[33] Susten Pass, Bernese Alps; 1♂; [A.N.S.P.].[34]

Italy: Penegal, Trentino; (Fruhstorfer); 1♂; [Hebard Cln.]. Trentino; (R. Cobelli); 1♂, 1♀; [Hebard Cln.].

Austria: Rannstein; VII, 20 and VIII, 3, 1904; (H. Karny) 1♂, 2♀; [A.N.S.P. and Hebard Cln.].[35] Pyreralpe; VII, 14, 1904; (H. Karny); 1♂, 1♀; [A.N.S.P.].[35] Styria; 1♀; [Hebard Cln.]. Graz, Styria; 1♂; [Hebard Cln.].

Yugo-Slavia: Bjelasnica Mountains, near Sarajevo, Bosnia; VIII, 3 and 5, 1929; (V. Martino); 2♂, 10♀; [Hebard Cln. and A.N.S.P.]. Mali Igman Mountains, Bosnia; VII, 26, 1929; (V. Martino); 1♀; [Hebard Cln.].

Soviet Union: Government Olonets; VII and IX, 1920; (Djakonov); 1♂, 1♀; [Hebard Cln.].[36] Government Tobolsk,[37] West Siberia, VI, 16, 1901; 2♂, 1♀ (all macropterous); [Zoolog. Mus. Leningrad, A.N.S.P. and Hebard Cln.].[36] Sloboda, region of Balagansk, Government Irkutsk, Siberia; VII, 22, 1898; (Igenitzski); 1♂, 1♀; [Hebard Cln.].[36]

Podisma carpetana (I. Bolívar)

1898. *P[ezotettix] pedestris* var. *carpentanus* I. Bolívar, Annaes Sci. Naturaes, Porto, v, p. 33. [Escorial, Navacerrada and La Granja, Central Spain.]

This isolated form is clearly a distinct species and not a variety of *pedestris*. While the features originally given by Bolívar are not fully diagnostic of *carpetana*, the form of the pronotum and of the lateral lobes in both sexes, the much more reduced tegmina, the heavier caudal femora of the male and certain features of the coloration are amply sufficient to differentiate the Sierra de Guadarrama species.

Specimens examined.—56; 30♂, 26♀.

Spain: Above Cercedilla, Sierra de Guadarrama; VIII, 27, 1927; (B. Uvarov; in pine forest); 24♂, 24♀; [Hebard Cln. and A.N.S.P.]. Puerto de Navacerrada, Sierra de Guadarrama, 5500-6000 feet, VIII, 17, 1927; (B. Uvarov); 6♂, 2♀; [Hebard Cln. and A.N.S.P.].

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[33] Reported by Hebard, Trans. Amer. Entom. Soc., LI, p. 48, (1925).

[34] Received from and determined by Henri de Saussure.

[35] Determined by H. Karny.

[36] Determined by E. Miram.

[37] We are unable to transliterate the poorly written Russian script of the exact locality for these specimens.

Podisma emiliae Ramme

1926. *Podisma emiliae Ramme,* Deutsch. Entom. Zeitschr., 1926, p. 279, pl. 2, fig. 10, text-figs, 1b and 2b. [♀; Val Gorgo, Etruscan Apennines, Emilia, Italy (type locality); Monte Cimone, Etruscan Apennines, Emilia, Italy.]

1935. *Podisma emiliae* Salfi, Bollett. Lab. Zool. Gener. Agrar. Portici, XXVIII, p. 214, figs. 2a-f. [Full descriptions and figures of both sexes.]

Salfi's very full treatment of this species is based on an examination of one male and three female topotypes from Val Gorgo. The material before us consists of part of the original Monte Cimone series received in exchange from Dr. Menozzi. Salfi's figure 2e is incorrect in its outline of the lateral margin of the ultimate sternite, which is distinctly sigmoid, as in *pedestris* and *carpetana,* and not obliquely concave as shown. The species is apparently localized in the Etruscan Apennines.

Specimens examined.—4; 1♂, 3♀.

ITALY: Monte Cimone, Emilia, (C. Menozzi); 1♂, 3♀; [Hebard Cln.].

Podisma uvarovi Ramme

1926. *Podisma uvarovi* Ramme, Deutsch. Entom. Zeitschr., 1926, p. 278, pl. 2, figs. 9a and b, text-figs, 1a and 1b. [♂, ♀; Oschtur, northwest Caucasus, 1600-1700 meters.]

We have before us a virtually topotypic pair, received from and determined by Dr. Miram.

Specimens examined.—2; 1♂, 1♀.

SOVIET UNION: Maikop, Kuban, northwest Caucasus; IX, 20, 1935; (Deev); 1♂, 1♀; [A.N.S.P.].

Podisma sapporensis Shiraki

1910. *Padisma* (sic) *sapporense* Shiraki, Acrididen Japans, p. 76, pl. 2, figs. 5a-c. [♂, ♀; Ziosankei and Sapporo, Japan.]

From the evidence of a Sapporo specimen this species is seen to be a true *Podisma* and in position stands between the four species already treated and *P. hesperus.* With the latter *sapporensis* agrees in details of the fastigium, as well as in its profile, the type of frontal costa and the form of the caudal femora, while in the pronotal form it is probably nearer the other Eurasian species which we have examined. These comments have been drawn solely from the female sex, the only one known of *P. hesperus,* and that we have seen of *sapporensis.*

Specimens examined.—1; 1 ♀.

JAPAN: Sapporo Agricultural College; XII, 1896; (M. Matsumura); 1 ♀; [Hebard Cln.].

Podisma hesperus (Hebard)

1936. *Dendrotettix hesperus* Hebard, Trans. Amer. Entom. Soc., LXII, p. 186, pl. 13, figs. 7-9, pl. 17, fig. 3. [♀ ; Alder Springs, west of McKenzie Pass, Cascade Mountains, Lane Co., Oregon.]

The unique type of this interesting species is before us, and it proves to be a true *Podisma,* more nearly related to *P. sapporensis* of northern Japan than any other. While, as our colleague, Mr. Hebard, stated when describing the species, some affinity with *Dendrotettix* appears to exist, the sum total of all its characters definitely removes it from that genus, and places it as a terminal member of the series of *Podisma* species known to us from material.

When compared with *sapporensis, hesperus* is seen to differ in the slightly shorter and less bullate and less inflated dorsum of the metazona of the pronotum, the posterior margin of which is broadly arcuate with a subobsolete and very shallow concavity mesad; the lateral lobes of the pronotum are definitely shorter and proportionately deeper, the anterior and median limbs are slightly shorter and the latter more slender, while the posterior femora are more slender in lateral aspect; the cerci (of the female) are stouter and more trigonal, the ultimate tergite of the same sex is acutely trigonal, and the process of the distal margin of the female ultimate sternite is rectangulate instead of moderately acute; the tegmina are larger, reaching nearly to the distal margin of the proximal abdominal sternite. The original figure of the distal margin of the ultimate sternite of the type of *hesperus* (pl. XIII, figure 9) is erroneous, as the apex of the angle of the same is distinctly sharper and more aciculate. The venation of the tegmina of *hesperus* strongly suggests that of *P. pedestris,* the outline of these, however more subelliptical and with less emphasis of the distal lobulation, which is generally so well developed in brachypterous individuals of *pedestris.*

The senior author accompanied Mr. Hebard when the type of this striking species was collected, and is familiar with the conditions on the western slope of the Cascade Range where it was taken. In this area of North America occurs a high percentage of types of Old World relationship, and usually these are forms of relatively limited distribution, probably the most recent intrusives.

While in years past a number of North American species have been regarded as members of the genus *Podisma* these placings have now been corrected, chiefly by the studies of Hebard and the present authors. The form here discussed is the only one from the New World now known which can definitely be referred to *Podisma*.

Specimens examined.—1; 1♀.

OREGON: Alder Springs, Cascade Mountains, Lane Co., elevation 3700 feet; VIII, 24, 1928; (R. & H.); 1♀ (type); [Hebard Cln.].

DENDROTETTIX Packard

1890. *Dendrotettix* Packard, Fifth Report U.S. Entom. Comm., p. 214.

GENOTYPE (by monotypy): *Dendrotettix quercus* Packard.

In a previous paper we summarized the generic features of the genus *Dendrotettix*[38] and discussed the two species then placed in it. At this writing we have little to add to this previous systematic discussion, or to the information on the distribution and binomics of the genotypic species (*D. quercus*) given by us in a very recent contribution.[39]

In a linear arrangement of the genera of the *Podisma* complex *Dendrotettix* stands next to *Podisma* in the sequence leading to *Appalachia*, which latter has a more terminal position. With the genotype of *Podisma* (*P. pedestris*), that of *Dendrotettix* (*D. quercus*) shares the occurrence of marked dimorphism, but in the latter case there is a more even percentage of the two structural types than in *P. pedestris*, where the macropterous individuals are exceedingly scarce, and may even have a regional correlation. In *Dendrotettix*, on the other hand, any extensive colony of *quercus* may show, during its seasonal occurrence a considerable percentage of macropterous specimens of both sexes. This, at least, is the conclusion which seems warranted from studies made to date.

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[38] "On New or Redefined Genera of Nearctic Melanopli (Orthoptera: Acrididae)." *Trans. Amer. Entom. Soc.*, LXII, pp. 1-30, pls. 1-2, (1936). (Discussion of *Dendrotettix*, pp. 19-28.)

[39] "The Post-Oak Locust (*Dendrotettix quercus*) in the Eastern United States, with Notes on Macropterism in the Species (Orthoptera: Acrididae)." *Trans. Amer. Entom. Soc.*, LXIV, pp. 79-95, pls. 5-6, (1938).

From *Podisma* the present genus differs chiefly in the general build being more elongate fusiform instead of short and broad fusiform, in the more elongate antennae, the proportionately larger and more inflated head, in the more decided strangulate pronotum as seem in both dorsad and lateral aspects, in the prozona of the pronotum being longer than the metagona,[40] in the dorsal surface of the metazona of the pronotal disk being definitely deplanate (except for the very evident median carina) and cribrosely impressed, in the posterior margin of the same always lacking a median emargination of any character, in the lateral shoulders of the metazona being distinct and definite but not carinate, in the fastigial excavation being more broadly and sharply depressed within its quite sharply indicated and subcarinate lateral margins, in the anterior and median femora of the male being hardly at all bulbosely inflated, instead of quite definitely so as in *Podisma,* in the posterior femora being much more slender and tapering in depth through much of the length, in the more elongate and narrowly subequal, instead of shorter, more depressed and subexpanded, metatarsi of the posterior limbs, in the male cerci being sublamellate and twisted distad, instead of conically tapering as in *Podisma,* in the male ultimate tergite (supra-anal plate) having paired lateral transverse ridges mesad, instead of lacking them in this position but with paired mesodistal node-like ridges distad, as in *Podisma,* and in the female ultimate sternite (subgenital plate) having the median angle of the distal margin obtuse, and not produced into an acute subrostration as in *Podisma,* while the converging lateral portions of this margin are not markedly concave, as they are in *Podisma.*

The distribution of the present genus is particularly interesting in that its more widely spread species has, as far as at present known, a markedly discontinuous type of distribution, while the more localized one apparently has a very circumscribed range well removed from either of the areas inhabited by the other species.

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[40] The rather aberrant *Podisma* species of Japan and the western United States (i.e. *P. sapporensis* and *hesperus*) are nearer *Dendrotettix* in this feature, but the true relationship is evident in their agreement with *P. pedestris* in virtually all the other differentials here discussed.

The early history of the genus probably parallels that of a number of southeastern North American types of Asiatic ancestry, an element in the Nearctic biota distinctly more ancient in its occurrence there than the Cordilleran element of Asiatic relationship.[41]

In preglacial Pleistocene times *Dendrotettix* probably occupied a considerable area in the eastern United States. Conceivably, from what we know of its habits, the genus was restricted to forested territory, and doubtless no more tolerant of extremes of temperature, than it is today. The earlier glaciations, i.e. Jerseyan, Nebraskan, Kansan and Illinoian, by their more extensive penetration southward, could have been responsible for the present-day differentiation and isolation of *D. zimmermanni* in the more southern Appalachians, while a more adaptable form, probably through its dimorphism responsive in a greater degree to the ebb and flow of climatic forces, persisted at lower levels, although divided into two populations by the great lobes of the earlier ice sheets in the Mississippi and Ohio valleys, and the relatively cold and perhaps physically effective barrier of the Appalachians in the Virginias and Pennsylvania. This explanation would account for the at present separated eastern and western populations of *D. quercus*.[42] With the gradually less extensive invasions of the ice subsequent to the Illinoian, the north-central section of the Mississippi Valley area in which *D. quercus* now occurs, i.e. northern Missouri, southern Iowa and most of Illinois, became increasingly inhabitable, and by the time of the Kirkfield and Chicago stages the occupation of all the territory now inhabited by *D. quercus*, both in the east and west, was a possibility. The late Pleistocene continuity of the Long Island and New Jersey areas now inhabited by *D. quercus* was quite possible by the avenue of the then exposed but now 'submerged continental shelf.

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[41] See J. A. G. Rehn, relative to the probable history of the genera *Chloealtis*, *Chrysochraon* (in the New World) and *Napaia*: *Proc. Acad. Nat. Sci. Phila.*, LXXX, pp. 190-191, (1928).

[42] See Rehn and Rehn: "On New or Redefined Genera of Nearctic Melanopli (Orthoptera: Acrididae)"; *Trans. Amer. Entom. Soc.*, LXII, p. 21, footnote 33, (1936): "The Post-Oak Locust (Dendrotettix quercus) in the Eastern United States, with Notes on Macropterism in the Species (Orthoptera: Acrididae)"; *Trans. Amer. Entom. Soc.*, LXIV, p. 90, (1938).

Dendrotettix quercus Packard

1890. *Dendrotettix quercus* Packard, Fifth Rep. U. S. Entom. Comm., p. 214. [Juvs.; Between Washington and Brenham, Washington County, Texas.]

1891. *Dendrotettix longipennis* Riley, Insect Life, v, p. 255. [♂, ♀; Manor, Travis County, Texas.]

We refer the interested student to our discussion of the synonymy, type material and distribution of this species which was published in 1936,[43] and our later, more detailed treatment of *quercus* as found in the eastern United States.[44]

Dendrotettix zimmermanni (Saussure)

1861. *Pezotettix zimmermanni* Saussure, Revue et Magasin de Zoologie, 2e ser., XIII, p. 159. [♀; " Carolina ", i.e. South Carolina, as the label on the type shows.]

1936. *Dendrotettix zimmermanni* Rehn and Rehn, Trans. Amer. Entom. Soc., LXII, p. 22.

A discussion of the type material, nomeclatoral history, then known distribution and binomics and detailed description of the female sex will be found in our above listed 1936 paper.

The male sex was unknown to us in 1936 and we have reason to believe that the male specimens from Allardt, Fentress County, Tennessee, recently recorded by Hubbell[45] as males of *zimmermanni*, represent instead a distinct form. The male cerci of these are stated by Hubbell to be nearer to the type found in *Appalachia*,[46] which taken with other available information still to be fully studied, points to the above conclusion.

APPALACHIA Rehn and Rehn

1936. *Appalachia* Rehn and Rehn, Trans. Amer. Entom. Soc., LXII, pp. 5, 9.

GENOTYPE (by original designation): *Appalachia hebardi* Rehn and Rehn.

This distinctive genus has been fully described in the above-mentioned paper, and we have nothing to add which would in any way modify our previous statements.

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[43] Trans. Amer. Entom. Soc., LXII, p. 28, (1936).

[44] Trans. Amer. Entom. Soc., LXIV, pp. 79-95, (1938).

[45] Occas. Papers Mus. Zool. Univ. Mich., no. 389, p. 2, footnote 3, (1938).

[46] Occas. Papers Mus. Zool. Univ. Mich., No. 389, p. 6, footnote 5, (1938).

When studied with all the other genera involved in the *Podisma* complex, which was not done in 1936, we find ample support for our previous conclusions that *Appalachia* has its nearest relative in *Dendrotettix*. However, we would now consider *Appalachia* the terminal member of this complex, more divergent from *Podisma* than is *Dendrotettix*, which latter linearly stands between the other two. In the previous paper we also compared *Appalachia* with *Zubovskya*, but the latter we now regard as a member of another complex, which will be discussed in detail in the very near future.

The chief characters separating *Appalachia* from *Dendrotettix* have been tabulated by us in a key for the separation of these genera,[47] which requires no modification. When compared with *Podisma*, *Appalachia* is seen to agree with *Dendrotettix* in the prozona being distinctly longer than the metazona, while the simple male cerci are nearer the type of *Podisma* than they are to that found in *Dendrotettix;* from *Podisma*, *Appalachia* differs further in the more slender, less fusiform build, in having a transverse, less rounded type of fastigium, as in *Dendrotettix*, in the markedly slender posterior femora, in the definitely longitudinal and distally more acute ultimate tergite (supra-anal plate) of the male, which also lacks paired distal surface nodes, in the shorter and less recurved prosternal spine, in the ovipositor valves of the females being slender, subcompressed and attenuate instead of short, deep and relatively broad as in *Podisma*.

Several of these features, as the form of the prosternal spine and that of the posterior femora are less pronounced as differential features when *Podisma sapporensis* Shiraki and *P. hesperus* (Hebard), are considered, but the agreement of these species with *Podisma pedestris*, and their consequent disagreement with *Appalachia*, in the greater number of the differential features here given, shows their correct systematic association.

Today the genus *Appalachia* is known from two forms occurring in different areas, i.e. Appalachian ridges in Pennsylvania, Virginia and West Virginia (*hebardi*) and the northern half of the lower peninsula of Michigan (*arcana*), with no representative of the genus occurring in the intervening territory.

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[47] Trans. Amer. Entom. Soc., LXII, pp. 5 and 6, (1936).

Probably *Appalachia* has had an evolutionary history in the Pleistocene and Recent somewhat similar to that of *Dendrotettix.* We can safely assume it is a member of the same large group of forms of life found in the eastern United States of relatively old Asiatic ancestry as *Dendrotettix.* Similarly it is possible it was more widely spread in that territory in pre-glacial times, and that the invading ice sheets crowded it southward.

During the later stages of the Wisconsin glaciation an increasingly larger area of the lower peninsula of Michigan was uncovered,[48] while as early as the Cary Stage, Lake Maumee acted as at least a partial barrier to the eastward spread of life forms reoccupying uncovered land. Followed by its successors, Lake Whittlesey in the Early Mankato Stage, Lake Lundy in the Later Mankato and Lake Erie of subsequent stages and the present time, with the Huronian lobe of Lake Algonquin and the present Lake Huron, this water barrier has persisted, probably effectively limiting the eastward distribution of certain non-flying genera, such as *Appalachia.* Given a common ancestor forced southward in pre-Wisconsin periods, with a maximum extent of the ice quite to the Ohio River in parts of Indiana and Ohio, it is logical to conclude that a division of the eastern and more western communities probably resulted. The eastern stock after the Cary Stage would have been able to move northward into suitable land then safely distant from the ice sheets of the Mankato stages, and even narrowly into land already uncovered by the ice. At the same time it was possible for the more western individuals to have maintained their existence a relatively short distance to the southward of the Driftless Area, and as the Cary Stages opened up a refuge to the northward to have moved into the lower Michigan peninsula, and there found a home between the then Lake Chicago and the contemporaneous Lakes Maumee and Whittlesley. Continued movement northward, with the correlated steady warming of the more southern country to which they had been driven by the earlier ice, would have precluded reversing their movement and thus rejoining their former relatives, now existing in scattered localities in Pennsylvania, Virginia and West Virginia as *A. hebardi.*

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[48] The major features of the late Pleistocene stages here discussed have been drawn from "Outlines of Glacial Geology," by F. T. Thwaites. 1935.

Appalachia hebardi Rehn and Rehn

1936. *Appalachia hebardi* Rehn and Rehn, Trans. Amer. Entom. Soc., LXII, p. 10, pl. 1, figs. 1 3, pl. 2, figs. 12, 16, 20. [♂, ♀; Buffalo Flat, between Buffalo and Branch Mountains, Union Co., Pennsylvania (type locality; Moosic Lake, Lackawanna Co., Penna.; near Poplar Gap, Monroe Co., Penna.; east of Leonardville, Carlon Co., Penna.; Kennedy's Peak, Massanutten Mtn., Virginia; Elliott's Knob, Augusta Co., Va.; Big Bald Knob, Augusta Co., Va.; Camp Todd, Augusta Co., Va.; Sounding Knob, Monterey, Highland Co., Va.; Bald Knob, Bath Co., Va.]

The localities listed above are all those from which this species has been recorded, except Catamount Trail, near White Sulphur Springs, West Virginia. For a full discussion of this species, reference should be made to the above cited paper.

Appalachia arcana Hubbell and Cantrall

1938. *Appalachia arcana* Hubbell and Cantrall, Occas. Papers Mus. Zool. Univ. Michigan, no. 389, p. 2, pl. 1. [♂, ♀; north of Oscoda, Iosco Co., Michigan; Van Etten Lake, Iosco Co., Mich.; seven miles south of Military Reservation, Crawford Co., Mich.; north end of Higgins Lake, Mich.; Lyons Manor, Roscommon Co., Mich.; five miles northwest of Lyons Manor, Missaukee Co., Mich.; Leota, Clare Co., Mich.]

The study in which *A. arcana* is described also contains important notes on the habitat, habits and life history of the species.

EXPLANATION OF FIGURES

PLATE VI

Fig. 1.—*Ognevia sergii* Ikonnikov. Male (*allotype*). Novowladimirov, Ussuri Province, U.S.S.R. Dorsal view. (× 2½.)

Fig. 2.—*Caudellacris omei* new species Male (*paratype*). Mount Omei, Szechuan, China. Dorsal view. (Approximately × 3.)

Fig. 3.—*Eirenephilus debilis* Ikonnikov. Male. Eastern Siberia, U.S.S.R. Dorsal view. (Approximately × 3.)

'Fig. 4.—*Ognevia sergii* Ikonnikov. Male (*allotype*). Novowladimirov, Ussuri Province, U.S.S.R Lateral view. (× 2½.)

Fig. 5.—*Ognevia sergii* Ikonnikov. Male (*allotype*). Novowladimirov, Ussuri Province, U.S S.R. Front view of head. (Greatly enlarged.)

PLATE VII

Fig. 6.—*Eirenephilus debilis* Ikonnikov. Male. Eastern Siberia, U.S.S.R. Lateral view. (Approximately × 3.)

Fig. 7.—*Caudellacris omei* new species. Male (*paratype*). Mount Omei, Szechuan, China. Lateral view. (Approximately × 3.)

Fig. 8.—*Ognevia sergii* Ikonnikov. Male (*allotype*). Novowladimirov, Ussuri Province, U.S.S.R. Lateral view of apex of abdomen. (Greatly enlarged.)

Fig. 9.—*Eirenephilus debilis* Ikonnikov. Male. Eastern Siberia, U.S.S.R. Lateral view of apex of abdomen. (Greatly enlarged.)

Fig. 10.—*Eirenephilus debilis* Ikonnikov. Female. Vicinity of Kartun, District of Vladivostok, U.S.S.R. Ventral view of distal margin of ultimate sternite. (Greatly enlarged.)

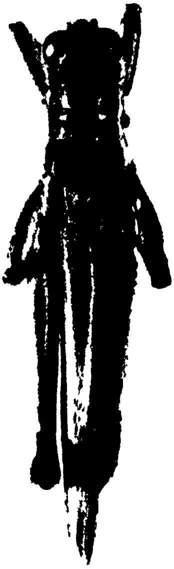
Fig. 11.—*Ognevia sergii* Ikonnikov. Male (*allotype*). Novowladimirov, Ussuri Province, U.S.S R Dorsal view of apex of abdomen. (Greatly enlarged.)

Fig. 12.—*Caudellacris omei* new species. Male (*paratype*). Mount Omei, Szechuan, China. Dorsal view of ultimate tergite. (Greatly enlarged.)

Fig. 13.—*Caudellacris omei* new species. Male (*paratype*). Mount Omei, Szechuan China Lateral view of ultimate sternite. (Greatly enlarged.)

Fig. 14.—*Ognevia sergii* Ikonnikov. Female. Evgenevka, region of Spaskava, Ussuri Province, U.S.S.R. Ventral view of distal margin of ultimate sternite. (Greatly enlarged.)

Fig. 15.—*Eirenephilus debilis* Ikonnikov. Male. Eastern Siberia, U.S.S.R. Dorsal view of apex of abdomen. (Greatly enlarged.)



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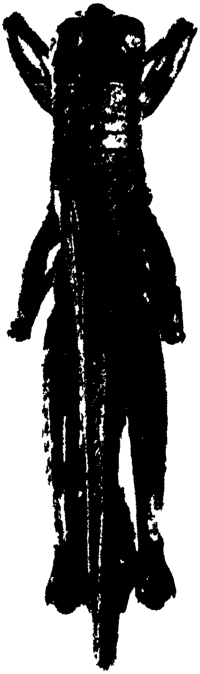

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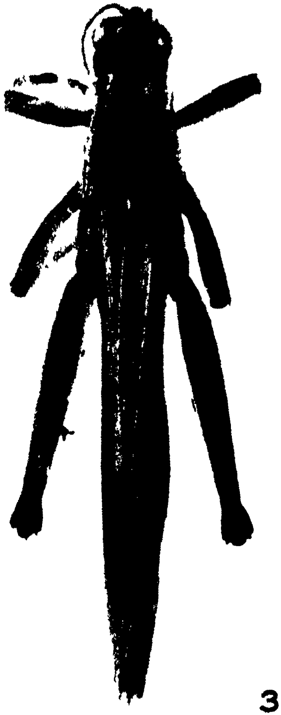

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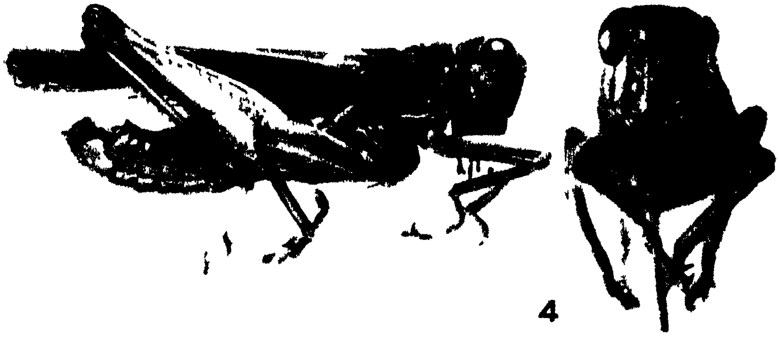

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REHN AND REHN—CYRTACANTHACRIDOID GENERA

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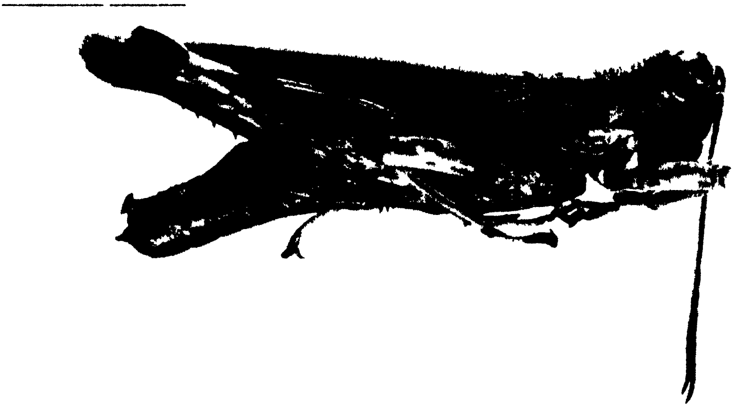

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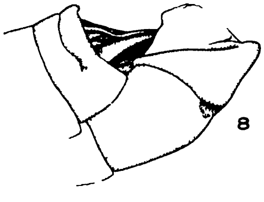

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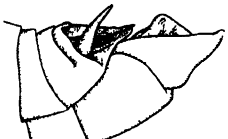

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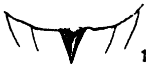

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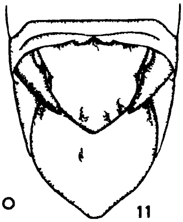

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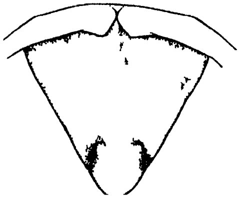

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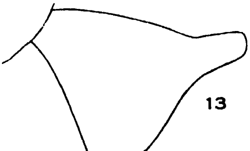

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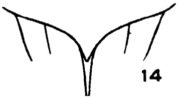

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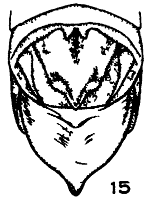

15

REHN AND REHN—CYRTACANTHACRIDOID GENERA

CONTRIBUTIONS TO THE NATURAL HISTORY OF HARPAGOXENUS AMERICANUS EMERY[1]

(HYMENOPTERA: FORMICIDAE)

BY LAURENCE G. WESSON, JR.
Harvard Medical School, Boston, Massachusetts

The genus *Harpagoxenus* is by no means unfamiliar to myrmecologists. *Harpagoxenus sublevis,* the European representative of the genus has been studied by Adlerz and Viehmeyer, and from their observations we may obtain a rough picture of its natural history. The American representative, *H. americanus,* is somewhat better known. It has been previously recorded from Washington, D. C. (Pergande), through New Jersey (Sturtevant), Beatty, Pennsylvania (Schmitt), Bronxville, New York (Wheeler), Tuxedo, New York (Creighton) to Woods Hole, Massachusetts (Sturtevant) and Boston, Massachusetts (Creighton). Pergande found it forming mixed colonies with *Leptothorax curvispinosus.* Wheeler (1910) showed that it is a parasite, dependent for its food and for the rearing of its brood on the *Leptothorax.* Little was known concerning it, however, until publication of papers by Sturtevant and Creighton. Sturtevant (1927) recorded the discovery of many colonies of this supposedly rare ant. He showed that the young dealated female, in a manner analogous to the young dealated females of *Formica sanguinea,* attacks a colony of one of the host species (*L. curvispinosus* or *L. longispinosus*) driving off the workers and appropriating the brood which, on emerging, adopt her. Creighton (1927), observing the slave raids of *H. americanus,* showed that it is a truly dulotic ant, and that it, like its European congener, conducts expeditions against neighboring colonies of the host species, killing or driving off the workers and carrying back the brood to be reared as slaves or auxiliaries. He corroborated

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[1] Contribution No. 40 from the Dept. of Biology, Haverford College.

Sturtevant's findings (1929) also on the behavior of the dealated female when establishing a colony, and recorded many other interesting observations. Nevertheless, the account of *H. americanus* which we have from these investigators is still fragmentary. They described no raid in its entirety,—those witnessed by Creighton being only the latter portions after the *Leptothorax* nest had been attacked. The method of formation and the meaning of the many queenless colonies had not been determined, and little was known concerning the life cycle. Accordingly, when I found numerous colonies of *americanus* in 1936 and 1937, I undertook an investigation to attempt to supply this information. So many new observations were made and so many previous ones checked that it is possible to present in this paper a fairly detailed account of the natural history of *H. americanus,* and to revaluate its status as a slavemaking ant. In so doing it will be necessary to repeat in detail much that has been observed by other investigators. I have grouped observations according to the phases of activity, rather than the order or the circumstances under which they were made.

The colonies of *americanus* referred to were found in Haverford, Pennsylvania, Baltimore, Maryland, and Southern Ohio. The general data concerning them is recorded in Table 1. Those from Haverford were found in a small, brushy, weedy, locality within an area of fifteen feet in radius on the Haverford College campus. It is interesting to note that all of them were found along the edge of a small path; and, while it cannot be said that there were no colonies well off the path, sufficient search was made to indicate that they could not be nearly as frequent there. The colonies from Baltimore were found, well distributed, in a small wooded tract in the city. Most of the colonies from southern Ohio were taken in Jackson county, while a few were taken in Pike, Hocking, and Vinton Counties.

As regards the proportion of *Harpagoxenus* to *curvispinosus* colonies, if the group taken at Haverford may be excluded on the ground that all the collecting was done in one place, and may not, therefore, be representative of the region as a whole, the total of *Harpagoxenus* colonies from Baltimore and Ohio was found to be about one for fifteen colonies of the *curvispinosus* found. This figure is roughly that given by Sturtevant (1927) for the colonies found by him in New Jersey where he found a ratio of one to thirteen. Since *L. curvispinosus* is an abundant ant in the eastern United States, *americanus* would seem to be by no means as rare as hitherto supposed.

TABLE I. List of the colonies of *Harpagoxenus americanus* found.

Colony No.	Date found	Harpagoxenus				Leptothorax[1]	
		☿	♀	♂	brood	☿	brood
H-1	May 18,1936	9	1d	0	16 p,6 l.l.	60	0
H-2	" " "	1	0	0	few m.l.	20	0
H-3	" " "	0	1d	0	0	15	0
H-4	Apr. 7,1937	3	0	0	80 s.l.	20	0
H-5	" 18, "	8	0	0	100 s.l.	many	0
H-6	" 30, "	3	1d	0	70 s.l.	"	0
H-7	" " "	6	0	0	80 s.l.	"	0
H-8	May 3, "	6	0	0	100 m.l.	30	0
H-9	" 7, "	0	0	0	20 m.l.	15	0
H-10	" " "	3	0	0	50 m.l.	20	0
H-11	Apr.23,1938	4	0	0	40 s.l.	40	0
H-12	" " "	1	0	0	21 s.l.	30	0
H-13	" " "	1	0	0	5 s.l.	25	0
B-1	June 17,1937	4	0	0	12 p.	15	0
B-2	" 18, "	17	1d	0	43 p.	50	0
B-3	" 23, "	14	1d.5w	0	81 p.	60	0
B-4	" " "	0	0	0	24 p.	14†	0
B-5	" " "	6	0	0	35 p.	30	0
J-1	July 4, 1936	(?)	(?)	0	10 p.	3	0
J-2	" 6, "	2	2d*	0	0	0	0
J-3	" 5, "	50	3d*	0	0	200	100
J-4	" " "	8	0	0	0	10	much
J-5	" 10, "	22	2d*	0	many s.l.	100	60
J-6	June 29,1937	8	1d	0	21 p.	30	0
J-7	" 30, "	1	0	0	18 p.	10	0
J-8	July 2, "	23	1d	2	(?) l.	many	many
J-9	" 11, "	9	1d,2w	1	(?) l.	20	20
J-10	Aug. 28, "	6	0	0	40 s.l.	30	0
J-11	" 23, "	0	1d	0	few eggs	5	4
J-12	" " "	0	1d	0	" "	8	3
J-13	" 16, 1938	24	1d	0	many s.l.	300	20
J-14	" " "	8	1d	0	" s.l.	100	15

w, winged; d, dealate; p, pupae; l.l., large larvae; m.l., medium larvae; s.l., small larvae; H, Haverford, Pa.; B, Baltimore, Md.; J, Southern Ohio.

[1] *L. curvispinosus* except for B-4.

* In colonies from which more than one dealated-queen is recorded, only one was definitely reproductive. † 12 *curvispinosus*, 2 *longispinosus*.

On discovery, the colonies were transferred to artificial nests where experiments could be performed on them at leisure. The nests consisted of small, wooden, glass-topped chambers entered by a narrow passageway and designed to imitate hollow galls, nuts, twigs and stems that the ants inhabit naturally. This small chamber was in turn placed at one end of a rectangular glass-topped box twenty by three to four inches in width. The ants nested in the small chamber and used the large box as a foraging area. Raids were observed either in these boxes or in a larger one (4 x 1 ft.) built for that purpose. The ants were fed fragments of insects, egg and sweetened fruit juice. Colonies captured three years ago are still thriving at the time of writing.

Development of the brood.—On the arrival of warm weather in the spring, the *americanus* brood is represented by a variable number of small larvae, that are rather uniform in size. This was the condition present in natural colonies found in the early spring, as well as in those which had spent the fall and winter in the artificial nest. These larvae, initially of a yellowish tinge and varying from one-third to one-tenth the bulk of a *curvispinosus* worker, developed uniformly, there being usually a spread of ten to twelve days between the pupation of the first and last larvae. The duration of the developmental periods was determined in the artificial nests to be approximately as follows: Length of semi-pupal stage, six to eight days; length of pupal stage, thirteen to fourteen days for males, fourteen to seventeen days for females and workers. These data were obtained during a single growing season; another season with a different mean temperature would probably give other figures.

No new larvae or eggs appeared in the nests until the overwintered larvae were pupating. The reason for this could hardly have been the fault of the artificial environment, since eggs begin to appear in nests of *curvispinosus* under similar conditions within a week after the commencement of spring activity. Furthermore, no eggs were found in wild colonies taken in late June after the growing season was well under way. Whether or not eggs were laid and immediately devoured, however, could not be determined, although in most cases the gaster of the reproductive individuals was visibly swollen by the time the larvae were half grown.

When the larvae are pupating, eggs begin to appear in numbers and continue to do so for several weeks; then their production rapidly tapers off. The larvae that hatch from these eggs grow quite slowly and seldom attain any size during the summer and fall. By diligent feeding, it was possible to cause many to attain one-half their growth, but on only one or two occasions did one pupate. Two other larvae reached the semi-pupal stage, but they shrivelled and died. Thus during the summer and fall the brood comes to consist of a number of larvae, fairly uniform in size, which pass the winter in that stage, shrinking somewhat in bulk, and appearing in the spring as the spring brood discussed above. The length of the larval period is, therefore, somewhat less than one year. That such a cycle holds for colonies under natural conditions is indicated by the fact that no *Harpagoxenus* pupae were found in nests taken later than July 4th. Sturtevant reports July 20th as the latest date on which he took pupae which he was certain were *H. americanus*. This apparent single-brood-per-year condition of *americanus* is in marked contrast to *curvispinosus* which lays eggs steadily during the spring, and adults emerge throughout the summer and fall.

Thus far only three phases, males, winged females, and workers, have been found. Although hundreds of the winged phase and dozens of the workers have been observed, no ergatoids such as occur with European *H. sublevis* have been noted.

The wings of some few of the females failed to develop properly on emergence, and the deformed stumps were soon removed, either by the female herself or by the *curvispinosus* slaves. Such individuals remained in the nest, behaving like the workers. They did not attempt to go on the nuptial flights with the rest of the winged brood, and attacked nests of *curvispinosus* with the workers. Since such non-reproductive, dealated females often occur in the nests of *Leptothorax,* it is probable that no special significance attaches to this, and it may be assumed that this is the origin of the dealated, non-reproductive females found occasionally in natural nests.

Nuptial Flight.—In the artificial nests, the first flights occurred within a few days after the first emergence of winged phases, and succeeding flights occurred on favorable days thereafter until all had left the nest. This takes place about the second week in July for natural colonies in southern Ohio. The flights invariably took place during the first warm hours of the morning, lasted for one-half to three-quarter hours, and then ceased for the remainder of the day. The flights of *L. curvispinosus*, on the other hand, occurred during the evening. When a flight took place, the males showed little interest towards females of their own colony, but readily mated with females from other colonies when the two phases were put together in a jar. However, when the males and females from two different colonies were mixed before the nuptial flight, no mating was observed to take place. This apparent disinclination of the males to mate with females of the same colony, or with females of other colonies except during the nuptial flight makes extremely unlikely the possibility of insemination of the *americanus* workers. This is especially unlikely in view of the fact that the males remain in the nest for a relatively short time, during which the two phases are observed to pay little attention to one another. Also extremely small are the possibilities that workers and males from two different colonies will mate since the *americanus* workers do not appear outside the nest in any numbers until the nuptial flights are over.

Establishment of the primary colony.[2]—Immediately after mating, the females dealate themselves and seek a colony of *L. curvispinosus* or *longispinosus*. The behavior of the females was studied by introducing them into a box containing *curvispinosus* in a small nest chamber similar to that described above for the *americanus* colonies. Consequently the female had to attack the *curvispinosus* colony through a narrow nest entrance as under natural conditions. Her procedure consists in locating a nest of *curvispinosus*, obtaining entry by force, killing or putting to flight the adults, and appropriating the brood. One of the nine experiments carried out may be described here as typical of all.

A single, dealated female was placed in a box at 1:00 P.M. on May 20, 1937 (Temp. 85° F.) with a colony of *curvispinosus* consisting of one female, eight workers, two callows, five pupae and four or five larvae. The *americanus* female immediately ran to a corner where she preened herself. Five minutes later she began exploring, moving in a fairly rapid yet hesitant manner, occasionally stopping to examine more closely some bit of wood or debris. By 1:25 she had come to the rear of the nest chamber; then, after examining that area for a few minutes, she proceeded along a top edge of the chamber until she came to the front face in which was located the entrance of the *curvispinosus* nest. Here her manner changed; she became much more deliberate in her movements, and instead of leaving the nest, she kept circling as though she scented the presence of the *curvispinosus* colony. In about a minute she found the entrance, and, cautiously, with antennae extended, started to enter. In the entrance was a *curvispinosus* worker. For about two seconds the worker and female "sniffed" each other with their antennae; then the worker snapped at the female, and, almost simultaneously, so far as I could perceive, the female seized the worker by its antenna, and dragged it rapidly about three-fourths of an inch outside and to one side of the entrance where she released it so emphatically that the worker dropped to the floor of the box as though flung there. The female now became very excited and circled about the entrance with an extremely rapid, short-stepped gait. She quickly returned to the entrance, started to enter, and met another *curvispinosus* worker in the entrance. This worker she treated similarly to the last. When released, the worker was tremendously excited, running in circles with antennae folded and mandibles open. The female circled about it for a few seconds, avoiding being seized by the very rapid, jerky, shifty movements with which she moved in all directions with apparently equal facility. Several times she seized the *curvispinosus,* dragged it backward a few steps and again released it, an action by which she excited the worker more than she harmed it. By this time, the first worker had reentered the nest and excited the colony so that three workers emerged and ran excitedly about the entrance. These the female attacked indiscriminately, nipping and jerking them backward away from the nest entrance. Once she was seized by a worker, but threw it off, minus an antenna, in a few seconds; then she withdrew briefly to a point about one and one-half inch from the entrance to preen her antennae. Finally she came upon the entrance again on one of her circlings, and cautiously started to enter. Just at that point one of the *curvispinosus* workers outside the nest came upon her from the rear, causing her, thus stimulated, to dart into the nest. Inside, she resumed her nip-jerk tactics, but met with little opposition. The *curvispinosus,* workers and queen, already highly excited, became panic-stricken and fled, carrying with them one pupa and one larva. One worker remained behind, crouching in a corner. This the female worried intermittently, finally dragging it forcibly to the entrance. The remainder of her activities consisted in making a lengthy examination of the nest and brood, paying particular attention to the two callows. Occasionally she came partly out of the nest but never left it entirely. Twice *curvispinosus* workers cautiously tried to reenter the nest, but each time fled on the approach of the *americanus* female. By 2:30 she had gathered the four remaining pupae into a pile and was licking one of the callows, but paid no attention to the larvae scattered about the nest. If pupae were removed from the pile, she quickly returned them to it, but did not attack a straw inserted into the nest.

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[2] " Primary " colony refers to one founded by a single, migratory female, as opposed to the " secondary " or " branch " colony established by workers as the result of a raid or raids. The establishment of a secondary colony is described later.

A week after the female had captured the nest, two pupae had emerged and the female had laid several eggs. By September the female had six *curvispinosus* workers and eight or nine rather small, uniform *americanus* larvae that wintered in that condition and developed in the spring as did the brood described above. The variations in this behavior were minor.

The females are limited as to the size of the *curvispinosus* colony they can capture since they must put the workers to flight without being themselves incapacitated. If one is captured by four or five *curvispinosus* workers, she is seldom able to escape without being so disabled that she soon dies or is unable to resume the attack. The *curvispinosus* grasp legs or antennae, each pulling backward so that the *americanus* is pinioned and unable to bring them within the reach of her powerful, shear-like mandibles; they then proceed at leisure to saw through her legs or antennae. When, on the other hand, she is seized by only one or two workers, the *americanus* female is clearly superior. Because of the necessity of avoiding concerted attacks by the *curvispinosus*, no female of the nine so studied succeeded in entering a nest of as many as twenty *curvispinosus* workers. One was successful with fifteen, while only one was not successful with ten workers. The females seemed to be more successful when they were able to make an early entrance to the *curvispinosus* nest than when they were compelled to deal with a number of workers outside the nest. On two occasions several females readily joined in attacking a *curvispinosus* colony, and guarded the pupae together, but when the first *curvispinosus* workers emerged, the females, except one, immediately left the nest. The females have not been observed to fight among themselves, yet all but one go,—perhaps a necessary adjustment for a colony which would be too small to support adequately more than one female. The females that leave the nest seem to be in no way altered, for they readily attack another *curvispinosus* colony as though they had just descended from their nuptial flight.

Behavior of the workers.—During the winter and spring, until the time of the nuptial flight, the *americanus* workers do not leave the nest. Their principal activity seems to be cleaning one another, and begging for regurgitated food from the *curvispinosus* slaves. Also, they have been observed licking the heads of the larvae, perhaps obtaining some secretion from these. They have not been seen eating solid food brought into the nest by the *curvispinosus* slaves, but have been seen drinking water and sugar syrup which they came upon outside the nest.

Immediately after the nuptial flights, the *americanus* workers begin scouting for *curvispinosus* or *longispinosus* nests. At first only two or three appear at a time, but soon, as the season advances, they appear in numbers. The first workers appear in the morning hours as soon as the temperature reaches about 75° F., and continue to leave and return to the nest until evening. The behavior of the worker at such a time is characteristic. After emerging from the nest rather hesitatingly, she proceeds at an irregular pace, alternating short runs with periods during which she moves hesitatingly and cautiously, carefully examining objects and crannies with her antennae and often retracing her path for a short distance. She may thus spend several minutes examining a small area.

When an *americanus* worker is scouting, it is usually possible, in the artificial nest, at least, to cause a raid to take place. This is done by placing a colony of *curvispinosus* at the opposite end of the box from the *americanus* colony, and waiting until it is discovered by the searching scout. Twenty-five raids were thus observed under various conditions. The pattern, with few exceptions, was the same. The scouting worker discovers a colony of *curvispinosus,* locates the entrance, and returns quickly to the home nest for an army. There she rouses the colony so that she is able to go back in a few minutes to the *curvispinosus* colony followed by a fairly compact file of one to twenty-five *americanus* and a number of *curvispinosus* slaves. She leads the file by laying a scent trail which they follow. On reaching the *curvispinosus* nest, the workers attack it in the manner of the colony-founding female as described above, forcing their way into the nest where they quickly excite the *curvispinosus* into a panic. Once in full possession of the nest, they carry back the pupae and large larvae at leisure, several days often elapsing before they have completed the removal of the *curvispinosus* brood. During the raid itself, and later during the removal of the brood, *americanus* workers return occasionally to the home nest to bring back additional workers. Small *curvispinosus* larvae, and male and queen pupae they more or less neglect. The following is presented as a description of an approximately typical raid.

June 24, 1938: raid by colony J-3, which had shown scouting activity since May 20th. This colony had spent the winter in an artificial nest and contained at this time about 60 *americanus* workers, 600 *curvispinosus* slaves, numerous small *americanus* larvae, but no *curvispinosus* brood. The colony was now placed in the four-foot box at the opposite end from a colony of *curvispinosus* containing about 60 workers, a dealated queen, fifteen alate females, some males, many pupae, larvae and eggs. Some of the pupae were of the winged brood. At 10:00 A.M. no *americanus* were out, and the colony was put in a warm place where the temperature soon rose to 85° F. By 11:00 three scouts were out, and by 11:55, seven, two of which were close to the *curvispinosus* nest. The workers advanced irregularly, constantly examining the substratum and all objects and crevices with their continually moving antennae. Often they would retrace their steps for short distances as though to make sure that they had missed nothing. At 12:02, one scout came upon the nest, climbed up on one side, and proceeded toward the rear. The other scout, meanwhile, came to the front face of the nest in which was located the entrance and slowly climbed it. She soon met a *curvispinosus* worker, which scented and promptly attacked her. She easily dodged the worker, and paid no more attention to it, continuing her search for the nest entrance which she found in a few seconds. On locating the entrance she started to enter very cautiously, but was blocked by a *curvispinosus* worker. Worker and scout " sniffed " each other for about two seconds, then the worker attacked and was seized by the *americanus* scout, which rapidly backed away dragging the *curvispinosus* with it. The scout quickly shook off the worker and returned at once to the home nest, where she arrived at 12:07. Inside the nest she quickly combed her antennae, then ran excitedly about, causing considerable excitement among both the *americanus* and their slaves. At 12:10 she emerged from the nest followed by a compact file of eight *americanus* and five *curvispinosus*. The gait of the leader was peculiar. She ran with a rather slow, sprawling, stiff-legged movement, running forward a few steps, then waiting until a following worker touched her on the gaster before moving a few steps farther. By gently touching her gaster with a hair it was possible to cause her to move as though touched by another ant. In her progress, she kept her gaster deflected stiffy downward, in all probability laying a scent trail from it. This was demonstrated by the fact that following workers followed precisely the path taken by the leader even when that path was very irregular. On several occasions workers were observed following her exact path when separated from her by several inches. The file moved rather slowly due to the uncertainity and slowness with which the leader moved, arriving at the *curvispinosus* nest about four minutes after starting. The *curvispinosus* slaves tended to drop back and become lost as the file proceeded until there remained only two. When the file reached the *curvispinosus* nest, the leader proceeded up the face toward the entrance with but little hesitation. Just before she reached the entrance, however, she met a *curvispinosus* worker which promptly attacked her. The *americanus* responded with the peculiar, rapid, circling movements, retreating a short distance with the *curvispinosus* worker, then throwing it off and returning toward the entrance, without resuming her position at the head of the file. She quickly found the entrance, and this time succeded in entering without being blocked by *curvispinosus*. She was immediately attacked by *curvispinosus* workers, but for about ten seconds she avoided capture by her very rapid, shifting and erratic movements during which she ran several times around the chamber, nipping and pulling at the workers. These tactics were tremendously exciting to the *curvispinosus*. By the time she was captured by several workers which fastened to her legs and antennae, she had thrown the whole colony into turmoil. The *curvispinosus* queen and about fifteen workers, many of them callows, fled, several carrying larvae or pupae. Meanwhile, the remaining file of *americanus* workers, when deserted by their leader, milled about as though searching for the trail. When they encountered the outflux of excited *curvispinosus* workers caused by the leader, their behavior changed. The group scattered, each *Harpagoxenus* worker now behaving as though it were a scout searching for the entrance. They dashed rapidly about with their short-stepped, quick, circling movements which effectively kept them out of the reach of the *curvispinosus*. The latter, having just fled from their nest, were little inclined to offer resistance, and those that did were soon injured or dispersed by the nipping and pulling they received from the *americanus*. In a typical case, an *americanus* worker would seize an excited *curvispinosus*, pull it backward a half inch, release it, then pull it again before returning to look for the entrance. Occasionally a *curvispinosus* would succeed in seizing an *americanus*, but after a brief combat the latter would throw it off minus an antenna or leg. In less than a minute, five or six *americanus* found the entrance to the *curvispinosus* nest. They went repeatedly to the entrance, only to meet a *curvispinosus* worker which they forcibly extracted. This resulted in there being a large number of excited *curvispinosus* about the entrance. Two *americanus* were each seized by several *curvispinosus* which pinioned them so that they could not bring their captors within reach of their powerful mandibles. Finally, three *americanus* succeeded in entering the nest, where they repeated the performance of the leader, throwing the already highly excited *curvispinosus* into a panic. These fled precipitately, all save a few callows, some passive, mature workers, and most of the winged males and females. The latter remained clustered in one corner of the nest. Many of those that fled carried pupae and larvae with them. Soon two more *americanus* workers entered, and their possession of the nest was complete. This was at 12:18. One worker, shortly after entering, returned to the home nest and in a few minutes brought back a small file of two *americanus* and five slaves, of which three became lost on the way. One of the remaining slaves met and grappled with a worker of the raided colony, while the other entered the nest with the file. Three or four *americanus* worried the remaining *curvispinosus* workers and alate females, a procedure which usually resulted in their fleeing voluntarily or being dragged to the entrance and ejected. Many of the females refused to move, and as the excitement died down the *americanus* paid less attention to them. Some *americanus* were examining the brood, and were gradually joined by others. At 12:25 the first worker emerged with a pupa which she carried quickly to the home nest, covering the four-foot distance in less than a minute. This was exceptional, however, since other workers usually took from one to one and one-half minutes. Soon after this worker left with a pupa, two others appeared from the raided nest, one carrying a pupa, the other a larva, and proceeded to the home nest where they deposited their burdens just inside the entrance. Two of these three returned immediately to the raided nest, but the third appeared about a minute later leading a file of one *americanus* and two slaves. During the remainder of the afternoon and evening, most of the *americanus* carried pupae and larvae to the home nest. The number so engaged was gradually increased during the early afternoon by three or four particular workers that regularly returned with a file after each trip to the home nest with *curvispinosus* brood. However, from about two o'clock on, such files usually contained two or three *curvispinosus* slaves and no *americanus*. At the high point of activity, about 3:30, as many as twelve *americanus* were transporting *curvispinosus* brood, the workers thus engaged spending little time in either the home or the raided nest. They took all the worker pupae and large larvae, and avoided taking, as a rule, small larvae, eggs, and male and queen pupae. They did, however, take back the following in addition: About eight very small larvae, one male, two winged females, two male and two queen pupae, one living and one dead *curvispinosus* worker, and one pupal exuvium. Most of these were transported during the late afternoon when supplies of the more desirable large larvae and worker pupae were nearly exhausted. Three *americanus*, on the other hand, remained in the raided nest and did not carry any *curvispinosus* brood. They were engaged principally in examining the captured nest and brood, cleaning themselves, and generally "making themselves at home". Occasionally they carried to the entrance and dropped: eggs, small larvae, male and queen pupae, and male and queen adults. Some of the larvae and pupae were carried an inch or more from the nest before being dropped. This activity was rather desultory and most of the male and queen pupae were simply ignored.

In the late afternoon the number of workers transporting brood increased. About 7:10 (temp., 69° F.) the last worker made the trip from the raided to the home nest with a *curvispinosus* larva and failed to return. About this time two *americanus* workers, and, in a few seconds, a third, emerged from the raided nest, but, instead of proceeding home, circled rather rapidly within one and one-half feet of the nest. Two *americanus* that had been injured in the fighting, one with a *curvispinosus* worker still attached to its leg, were found and carried by the mandibles, *Leptothorax* style, into the nest. The two workers immediately reappeared and continued their searching. In order to see whether they would rescue lost slaves as they did other *americanus*, several slaves were taken from the home nest and placed near the searching *americanus*. Within two minutes each *ameri-*

canus had found a slave, examined it briefly, then carried it, curled up over her head, back to the nest. The two workers reappeared, but finding no more members of the colony, they reentered the nest after the lapse of four or five minutes and did not reappear. This was at 7:17 (temp., 67° F.). Nine *americanus* remained in the raided nest overnight. The following morning, the box was put in a warm place, as before. When the temperature reached 74° F., three workers left the raided nest together, two carrying larvae, one a male pupa, and went without hesitation to the home nest. Almost simultaneously a worker left the home nest and went to the raided nest. Transportation of brood continued during the morning and early afternoon, but much less vigorously than on the previous day. Only three or four workers were actively engaged in carrying brood, and these made the trips at greater intervals than before. Many workers resumed scouting. In mid-afternoon, two *americanus* were observed being carried to the home nest by other workers. At that time there were five *americanus* and many *curvispinosus* male and female pupae left in the nest. Here the experiment ended.

Observations on other raids reveal a number of points of interest which should be mentioned. These are listed below without describing in detail the raids in which they appear.

1) In all the raids observed, it was necessary for the scout to find the entrance to the *curvispinosus* nest before she would return to the home nest for an army.

2) On several occasions when a scout was presented with a small or easily penetrable colony, she attacked it directly. If repulsed, she returned to the home nest for auxiliaries; but if successful in capturing the colony, she did not bring additional workers until after she had begun the transportation of the brood.

3) Occasionally it happens that a scout that has returned to the home nest for a column starts out as a leader, but is not followed by any *americanus* or slaves. In such a case, the ant proceeds toward the *curvispinosus* nest with the gait of a leader, but much more slowly, as though waiting to be touched by following ants, yet impatient to proceed. The *curvispinosus* nest is hardly reached before she returns rather rapidly to the home

nest and again tries to bring out a file. Usually she briefly reconnoiters the *curvispinosus* nest before returning, but she sometimes returns before reaching it. During one raid by a small *americanus* colony on a cool day when there was little activity, a scout made two such futile trips in succession before she succeeded in bringing a file of two *curvispinosus* slaves.

4) The scent trail deposited by an *americanus* worker leading a file seems to be more than an indicator of the path. In addition it seems to excite the instinct to follow in other workers. On many occasions I have seen stray *americanus* or their slaves come upon the leader of a column, and promptly follow with the rest. Once an *americanus* carrying a pupa to the home nest chanced to meet the leader of a small column going to the raided nest. The laden worker immediately reversed her direction and joined the column. She rapidly dropped back, however, probably because of her burden, and soon lost the trail; whereupon she resumed her journey to the home nest.

5) *Americanus* workers, when fighting with *curvispinosus,* keep their antennal scapes in the scrobes, presumably as protection for these delicate points.

6) During the attack on a *curvispinosus* colony, especially if considerable resistance is offered, *americanus* workers return to the home nest for auxiliary columns. Also, after the capture of the colony, some of the workers returning with the *curvispinosus* brood bring files with them when they go back to the raided colony. These auxiliary files are almost invariably accompanied by, and sometimes composed wholly of *curvispinosus* slaves.

7) The tactics employed by the *americanus* in exciting a *curvispinosus* colony to a panic is illustrated by the exaggerated behavior of the *americanus* in the following experiment. An *americanus* colony was permitted to attack a non-responsive *curvispinosus* colony made by mixing together the brood and workers from several small nests. This composite colony was rendered "non-responsive" by thus forcibly breaking down the natural hostility of the workers of the different colonies toward one another; and in so doing the workers also lost temporarily most of their hostility toward workers of other colonies. When the *americanus* attacked this colony, the *curvispinosus* refused

to be panic-stricken or to resist. In their efforts to excite them to a panic, the *americanus* worked themselves to such a pitch of excitement in their erratic dashing about among the stolid *curvispinosus* workers that they often attacked one another. The raid ended with the *americanus* forcibly dragging the *curvispinosus* from the nest.

8) One *americanus* colony (J-3) was observed attacking another (J-4) under natural conditions. J-3 had already made a raid earlier in the day, and many workers were transporting the captured *curvispinosus* brood. Consequently, the column attacking J-4 was a small one comprising only five or six *americanus*. The raiding workers from J-3 attacked the other colony as they would a *curvispinosus* nest, snapping and pulling at the workers in their efforts to excite them. The *americanus* workers of the attacked colony responded with an identical behavior, and refused to be panic-stricken. Since there were very few *curvispinosus* slaves in the attacked colony, action was almost wholly between the *americanus*. It was amusing to see the *americanus* dashing excitedly about after one another, each treating the other as though it were a *curvispinosus*. There were very few combats at close grips, and those were of short duration, as the *americanus* appear to avoid that style of fighting.

9) In order to learn whether or not *H. americanus* would attack other species of *Leptothorax* than their usual slaves, a colony of *L. schaumi* was placed near a number of *americanus* scouts in the artificial nest. The scouts repeatedly walked over the nest chamber of the *schaumi*, and occasionally inserted their antennae in the entrance, but paid no attention to the *schaumi*. Finally the glass cover of the *schaumi* nest was drawn aside, partially exposing the brood chamber. A scout entered, walked about among the *schaumi*, examined some of them without exhibiting interest, and soon left. The *schaumi* showed only a slight hostility to the scout.

10) The *curvispinosus* slaves which accompany the *americanus* files behave much as do the slavemakers. They transport brood to the home nest, and occasionally return leading one or two additional slaves. Only once were the *americanus* and their slaves observed working in opposition to each other. On this

occasion, the *americanus* retained some captured brood in the captured nest while their slaves persisted in carrying it to the home nest. The raid in which this occurred is described later under " Establishment of the secondary colonies ".

11) In the raid described above in detail, it was noted that the *americanus* carried back a few of the male and queen pupae and adults, and some small larvae. This was exceptional, however, for in all other raids observed these portions of the *curvispinosus* brood were completely rejected. The adult males and queens brought to the home nest were killed by the *curvispinosus* slaves, but the pupae were retained and emerged in the nest. One of the emerged queens became dealated in the nest, and this may be the explanation of the source of *Leptothorax* females recorded from nests of *Harpagoxenus sublevis* in Europe.

12) Besides the influence of variations in the diurnal temperature, scouting activity appears to be materially affected by at least three factors:—(a) proximity of previous raids; (b) cumulative acquisition of *curvispinosus* brood; and (c) passage of the summer season. (a) On the days immediately following a raid, scouting activity is distinctly lessened, but recovers somewhat on succeeding days. (b) As the *americanus* colony acquires *curvispinosus* brood by successive raids, the scouting activity and the size of the raiding columns fall off markedly. This is shown by the following experiment: Two colonies, each comprising about thirty *americanus* and 100 slaves, were maintained under very similar conditions during spring and summer. About three weeks after scouting activity had begun, colony A was given 200 *curvispinosus* pupae and larvae, while colony B was given none. Two weeks later (July 12th) fifteen to twenty-five *americanus* could be seen scouting at one time from B, while from A only six to ten could be observed. (c) From about midsummer on, the activity, even in colonies which have received no *curvispinosus* brood, gradually declines. In the middle of August, activity is one-half or one-third its late July peak, while many colonies cease scouting entirely by mid-September.

Establishment of the secondary colonies.—In the detailed slave raid described above, it was noted that several of the *americanus* workers that went to the raided nest did not engage in transporting brood to the home nest, but remained and made themselves at home there. Of special significance was the fact that these workers removed from the nest small larvae and eggs as well as pupae and adults of the winged phases and dropped them near the entrance. In the early part of the season, the majority of workers transport captured brood to the home nest, eventually emptying the raided nest in a few days. In fact, some of the *americanus* and slaves that tend to linger in the captured nest may be carried to the home nest by other *americanus* workers. However, as the season progresses, and as the *americanus* carry out more and more raids, the number of workers that remain in the captured nest increases until all or nearly all do so, and little or no *curvispinosus* brood is transferred to the home nest. These *americanus* workers, some of their slaves which come with them, and the captured *curvispinosus* brood form a more or less permanent colony which may be termed a "secondary" colony. The cause of this change in the behavior of the *Americanus* workers has not been determined, but it seems to parallel the increasing amount of *curvispinosus* brood and adults in the home nest. It is clearly an accompaniment of declining raiding activity, and formation of secondary colonies usually marks the end of the season. The formation of such a secondary colony is now described.

August 11, 1938. Raid by colony J-3 which had made six raids during the summer, acquiring about 500 pupae and larvae, and which now showed greatly diminished scouting activity. The raided *curvispinosus* colony contained about thirty-five pupae and larvae and thirty workers. At 11:30 A.M. four *americanus* were scouting, two of them apparently veterans, with portions of legs missing. These two discovered the *curvispinosus* colony first, tried to enter, but were soon seized by the *curvispinosus* workers since they could not move rapidly enough to escape them. A few minutes later another scout found the nest, entered, left again when vigorously attacked, returned to the home nest and brought back a file of three *americanus* and two slaves. These quickly drove out the *curvispinosus* and took possession of the nest, being joined presently by one of the first two scouts which had freed herself. Two workers strolled about in the nest especially near the entrance, and spent considerable time cleaning themselves. The other two workers examined the brood, and occasionally picked up a small larva or egg and discarded it outside the nest. At 11:50 one of the workers that had been loitering near the entrance, left without carrying any *curvispinosus* brood, and returned to the home nest whence she soon emerged followed by a column of one *americanus* and three slaves. The column entered the captured nest a few minutes later. During the next three hours this worker made eleven such trips, each time going to the home nest empty-jawed, and returning followed by one or two *curvispinosus* slaves. A few of these slaves also made occasional trips to the home nest only to return followed by another slave. But one *americanus* worker, the one brought last to the raided nest, transported brood. After this ant had been in the nest about ten minutes she picked up a pupa and returned to the home nest with it. Until about 3:00 P.M. she made trips to the *curvispinosus* nest every ten or fifteen minutes, returning with a pupa or larva. After that the trips became much less frequent, and by 5:00 all activity had ceased between the two nests. At that time there were five *americanus*, fourteen or fifteen slaves, and eight or nine pupae and large larvae in the raided nest. The following day both colonies were warmed, but no *americanus* workers appeared from either nest. This raid marked the end of the season.

An apparent exception to the rule of late seasonal formation of secondary colonies appeared in a raid on June 18, 1937. Here there was a strong tendency to form a secondary colony early in the season, about two weeks after the commencement of scouting activity. The raiding colony (J-3) contained about forty *americanus* and some 350 slaves. Two days before the raid the colony had been given 400 *curvispinosus* pupae and larvae. The raided colony contained about 500 pupae and larvae. Both the *americanus* and their slaves energetically transported two-thirds of this; then the *americanus* stopped transporting brood, but the *curvispinosus* continued to do so. Finally, when the brood was nearly all removed, three or four *americanus* were observed transporting pupae from the home to the captured nest, while a number of the slaves were carrying them in the opposite direction. This continued for about an hour, when the nest was darkened. The following morning no more brood was transported. There remained in the captured colony ten *americanus*, about thirty slaves and about eighty *curvispinosus* pupae. The branch colony so formed was a stable one, and although it remained accessible to the parent colony for several weeks, there was little or no change in its size. Perhaps the large amount of captured brood effected in a short time that which usually requires all the season to develop. That secondary colony formation is not brought about by a mere mechanical crowding seems to be indicated by the fact that (1) secondary colonies are formed by *americanus* colonies living in fairly spacious weed stems, e.g., the series from Haverford where almost all the colonies had such nesting sites, yet secondary colonies were formed; (2) a large colony (J-3) was crowded into a nest chamber so small that it could not contain all of the slaves, yet when in that condition, it raided a *curvispinosus* colony containing a large amount of brood, no secondary colony was formed. There was, however, a decided tendency to this new colony formation as indicated by the number of workers that remained in the captured nest and did not engage in transporting brood. One week later the nest space was doubled, and the colony permitted to raid a small *curvispinosus* nest. This time the branch colony described above was readily formed.

The reproductive functions in the secondary colony are assumed by one of the *americanus* workers otherwise indistinguishable from the others. Eggs are laid which pass through the same developmental periods as in the colonies with a reproductive queen, but the sex ratios of the two kinds of colonies are quite different (Table 2). Of the colonies whose brood was raised in the artificial nest, seven contained reproductive queens. In all but one of these (J-6), the female brood outnumbered the male. The fourteen branch colonies each had a reproductive or gynecoid worker. During their first year in the artificial nest, the male brood outnumbered the female in all save three colonies. But since the larvae from which the first year brood of these three colonies was raised, and was present in them when they were found, the data is untrustworthy, for the colonies may have had queens which had recently died. When the colonies were kept in an artificial nest a second year, the ancestry of that year's brood was known, and in all the colonies males outnumbered females. In the second year especially, the proportion of colonies which had no female brood is high. This is what might be expected for the brood of unfertilized workers, so that it is significant that females were produced at all. The cases in which brood, known to be that of workers, is female-producing are:—H-1a and H-1c (branches of H-1) in the first year, and H-5 and H-1c in the second year.

TABLE II. Male and female brood of *Harpagoxenus americanus* raised in artificial nests during two successive years, listed by colonies.

Colonies with Reproductive Queens.

Colony no.	First year Female brood	First year Male brood	Second year Female brood	Second year Male brood
H-1*	22 (20☿,2♀)	0	-	-
H-6*	51 (4☿,47♀)	9	-	-
B-2*	37 (30☿,7♀)	6	-	-
B-3*	56 (30☿,26♀)	28	-	-
J-3	126 (36☿, 90♀)	70	310 (72☿,238♀)	213
J-5	116 (21☿,95♀)	12	-	-
J-6*	6 (5☿, 1♀)	15	-	-
Colonies with Reproductive Workers				
H-4*	7 (1☿,6♀)	71	0	125
H-5*	77 (34☿,43♀)	20	6 (3☿,3♀)	132
H-7*	8 (0☿,8♀)	68	0	73
H-8*	0	9	0	94
H-10*	25 (17☿,8♀)	17	0	50
B-1*	0	12	-	-
B-5*	23 (15☿,8♀)	0	-	-
J-7*	0	18	0	23
H-1c	9 (3☿,6♀)	25	2 (1☿,1♀)	121
H-1a	4 (1☿,3♀)	9	-	-
H-11*	6 (6☿,0♀)	41	-	-
H-12*	3 (1☿,2♀)	20	-	-
H-13*	0	9	-	-

* Colonies in which the larvae for the first year were produced under natural conditions. —Indicates that these colonies were studied for one year only.

Conclusions.—On the basis of the material recorded above, a revaluation of the status of *Harpagoxenus americanus* as a slavemaking ant may be attempted.

Wheeler (1910), the first investigator to record observations of *H. americanus*, concluded that this species was a " degenerate " or evanescent slavemaker, and " has every appearance of having reached a more abject stage of parasitism than its European congener ". Wheeler thus classed *Harpagoxenus* with *Strongylognathus* in which the slavemaking instincts are vestigial, and for which dulotic behavior and the whole worker caste is no longer necessary. As the basis for this conclusion, Wheeler had only the sluggish, inactive appearance of *americanus* workers while in the nest, and the small, apparently fragmentary colonies containing only a few *americanus* workers with many slaves so difficultly explained on the basis of slave raids.[3] Creighton (1928) regarded the slave raids of *H. americanus* observed by him as " ——— the last manifestation of a vanishing character. They show the decay of dulosis and foreshadow a state of abject parasitism ". Creighton's conclusions, similarly to those of Wheeler, were, however, drawn from observations that happened to be limited for the most part to those that would give the impression of decadence in *H. americanus*. For although he observed slave raids, Creighton saw only the later portions after the *Leptothorax* nest had been attacked.[4] Once the *americanus* are in possession of the *Leptothorax* nest, they are in no haste to remove the brood, often spending several days in doing so. But even the armies of the highly organized slavemaker, *Polyergus*, when returning to their nests with captured *Formica*, display much less organization and spirit than when starting out on a raid. Creighton may well be excused for being impressed by the appearance of disorganization of *americanus* workers, and for concluding that the raids were vestigial and take place only under optimum conditions.

But extremely misleading and conducive to erroneous conclusions is the use of *Polyergus* as a standard of reference by these authors. The amazon ants, *Polyergus,* early attracted attention, and were one of the first slavemakers to be extensively studied. Because of the brilliance and éclat of their raids, these ants have been regarded as the pinnacle of the development of dulosis. The *Polyergus* army leaves the nest in a close phalanx, apparently without any one, single leader. The ants proceed at a rapid pace to the nest of some species of *Formica* (*pallidefulva, fusca*), enter, seize the pupae and return immediately to their own nest. Creighton compares *Polyergus* with *H. americanus,* and tends to base his conclusions as to the status of the latter as a slavemaker on contrasts between the two forms. It seems obvious to me that the status (form, efficiency, organization) of a slavemaking species should be based on a study of both the species enslaved by it and the nearest related independent forms (these two may be identical in some cases (Wheeler, 1919)), not upon a comparison of the behavior of the slavemaker with slavemaking species in other, unrelated groups. For instance, *Polyergus* must adapt itself to the habits and behavior of the *Formicae* which it enslaves both to be able to execute slave raids efficiently and to form mixed colonies with a maximum adjustment to the host. *Harpagoxenus* must adjust itself to the behavior peculiar to the species of *Leptothorax* enslaved by it. But the habits and behavior of *Leptothorax* are quite different from those of *Formica. Formica* is an agile, fast-running ant, consequently *Polyergus* must be agile and fast-running also. *Harpagoxenus* does not run fast compared with *Formica* and *Polyergus,* but it does run faster than the *Leptothorax* which it enslaves. Moreover, *Polyergus* is derived from the genus *Formica* while *Harpagoxenus* is almost undoubtedly derived from *Leptothorax* (Wheeler, 1919). If that is the case, the behavior of these slavemakers must be derived from the behavior of the ancestral *Formicine* or *Leptothoracine* as the case may be. These two slavemakers could scarcely be expected to resemble one another unless derived from an immediate common ancestor, or through convergent evolution which would probably take place if both enslaved the same or related and similar species. The number, distribution and proportion of *H. americanus* colonies mark it as a successful ant. The swift and agile maneuvers executed by

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[3] Later Wheeler (1928) accepted Creighton's (1927) conclusions which, however, differed little from his own previous views.

[4] On the occasion that he found *americanus* attacking a *L. curvispinosus* colony, the former were apparently being bested by the defenders.

americanus workers when attacking a *Leptothorax* nest show a very distinct superiority of the former over their host. And most of the habits peculiar to *H. americanus* appear to be little more than modifications or exaggerations of traits found in *Leptothorax.* On the basis of such observations and considerations as these, using the host species as the standard of comparison, I would regard *H. americanus* as far from being an evanescent slavemaker and as occupying a position with respect to the *Leptothorax* which it enslaves quite analogous to that of *Polyergus* with respect to the *Formicae* enslaved by it. In some respects, such as the ability to eat unaided, and especially in the aggressive method of colony foundation of the migratory female, *H. americanus* is more primitive than *Polyergus.*

In conclusion, I wish to recommend these ants to the student of formicine behavior. Few ants are more ideally constituted for the laboratory study of slavemaking behavior. In the northeastern United States, at least, the host ants, *L. curvispinosus* and *L. longispinosus,* are abundant, easy to find, easy to collect, and simple to care for in the artificial nest. *H. americanus* is, as indicated, far from rare, and will perhaps be found to be one of the most common of our slavemaking ants. And its entire slave raid may be observed on the stage of a dissection microscope—next to an impossibility in the case of *Formica sanguinea* and *Polyergus.* Moreover, the recent discovery of a very primitive slavemaker, *Leptothorax duloticus,* in the subgenus *Mychothorax* (Wesson, 1937), the group from which *Harpagoxenus* probably arose, gives promise that this group may yet be our most fruitful one in the study of this unique and remarkable phenomenon—slavemaking among ants.

Summary. — 1. The habits and behavior of *Harpagoxenus americanus* are described. 2. Reasons are given for considering the slavemaking habits of this species as highly developed, and not evanescent as formerly supposed.

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THE GENOTYPES OF THE CHRYSIDIDAE

(HYMENOPTERA: TUBULIFERA)

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The Chrysididae have been neglected by workers in this country for many years, and as a result erroneous impressions of the genera and misidentifications of the species are all too common. This paper is presented as a preliminary step toward a revision of the entire group with the object of providing a definite basis for future taxonomic work and clarifying certain problems which have arisen in connection with various interpretations of the scope of the several genera.

The following system has been used in citing the designations under the name and reference to each genus: first, the type of the genus as recorded in the original publications; then, within brackets, the type species as originally described and any pertinent synonymy followed by the present taxonomic status of the type, insofar as I have been able to determine. The method by which the type designation was made is in parenthesis. Statements regarding isogenotypy have been added, and liberal use has been made of footnotes for discussion of special problems.

During the search for the genotypes, certain facts have been uncovered which clearly indicate that several of the names proposed by Lichtenstein in 1876 for subgenera of *Chrysis* must be replaced by older names. A summary of these necessary changes will be found in an appendix at the end of this paper.

The original references to all the genera and subgenera have been seen by the writer, and all generic names known to the author which have been applied to the Chrysididae have been included in this paper.

The author is indebted to Mr. V. S. L. Pate for many helpful suggestions and for critically reading the manuscript.

LIST OF GENERIC AND SUBGENERIC NAMES [1]

Achrysis Semenov Tian Shanskij, 1892. Hor. Soc. Ent. Ross., XXVI, p. 486.

TYPE: *Pseudochrysis* (*Achrysis*) *unicolor* (Dahlbom) [=*Chrysis* (*Hedychrum*) *unicolor* Dahlbom, 1831 = *Spinolia unicolor* (Dahlbom)]. (Monobasic and by original designation.)

Isogenotypic with *Gonochrysis* Lichtenstein, 1876, *q. v.*

Acrotoma Mocsary, 1902. Termeszetrajzi Fuzetek, XV, p. 537.

TYPE: *Acrotoma braunsii* Mocsary, 1902. (Monobasic.)

Adelphe Mocsary, 1890. Termeszetrajzi Fuzetek, XIII, p. 46.

TYPE: *Adelphe mexicana* Mocsary, 1890. (Monobasic.)

Allocoelia Mocsary, 1889.[2] Monogr. Chrysid., p. 62.

TYPE: *Allocoelia capensis* (Smith) [=*Anthracias capensis* Smith, 1874 = *Allocoelia capensis* (Smith)]. (Monobasic.)

Isogenotypic with *Anthracias* Klug, 1839 *nec* Dejean, 1833, *q. v.*

Amisega Cameron, 1888. Biol. Centr.-Amer., Hym., I, p. 457.

TYPE: *Amisega cuprifrons* Cameron, 1888. (Monobasic.)

Anthracias Klug, 1839 *nec* Dejean, 1833. Bericht. K. Preuss. Akad. Wiss., Berlin, p. 2. [No species.] Smith, 1874. Trans. Ent. Soc. London, p. 455. [One species.]

TYPE: *Anthracias capensis* Smith, 1874 [=*Allocoelia capensis* (Smith)]. (Fixed by Smith, 1874.)

Isogenotypic with *Allocoelia* Mocsary, 1889.

Brugmoia Radoszkowsky, 1877. [In Fedtschenko], Reise in Turkestan, II, p. 27.

TYPE: *Brugmoia pellucida* Radoszkowsky, 1877 [=*Euchroeus pellucidus* (Radoszkowsky)]. (Monobasic.)

Buyssonia Mocsary, 1902. Termeszetrajzi Fuzetek, XXV, p. 536.

TYPE: *Buyssonia dybowskii* (Buysson) [= *Hedychridium dybowskii* Buysson, 1897 = *Buyssonia dybowskii* (Buysson)]. (Monobasic.)

Calliste Lepeletier & Serville, 1825.[3] Encycl. Meth., X, p. 253. Nomen nudum.

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[1] This list is believed to be complete up to the end of December, 1937.

[2] Proposed by Mocsary for *Anthracias* Klug, 1839 which is preoccupied by *Anthracias* Dejean, 1833.

[3] In 1825 Lepeletier & Serville gave only the vernacular form *Calliste* for the genus they evidently wished to call *Callistus*. In 1828 when they completed volume ten, they found their name *Callistus* had been used previously by Bonelli (1813) [footnote, Encycl. Meth., X, p. 494] and therefore proposed the name *Pyria* for their group. The name *Calliste* cannot be validated as of 1828 since this form had been used in 1826 by Boie for a genus of birds.

Cephalochrysis Semenov Tian Shanskij, 1909.[4] Rev. Russ. Ent., IX, p. 224. [Three species.]

TYPE: *Chrysis* (*Cephalochrysis*) *sabulosa* (Radoszkowsky) [= *Chrysis sabulosa* Radoszkowsky, 1874 = *Platycelia sabulosa* (Radoszkowsky) = *Chrysis* (*Chrysis*) *sabulosa* Radoszkowsky]. (Type by present designation.)

Cephaloparnops Bischoff, 1910. Mitt. K. Zool. Museums Berlin, IV, p. 435.

TYPE: *Cephaloparnops elegans* (Klug) [= *Parnopes elegans* Klug, 1845 = *Cephaloparnops elegans* (Klug)]. (Monobasic.)

Chrysaspis Saussure, 1887. Soc. Ent., Zurich, II, p. 25.

TYPE: *Chrysaspis grandidieri* Saussure, 1887. (Monobasic.)

Chrysellampus Semenov Tian Shanskij, 1932. Hor. Soc. Ent. Ross., XLII, p. 5.

TYPE: *Chrysellampus heros* Semenov, 1932. (By original designation and monobasic.)

Chrysidea Bischoff, 1913. Gen. Insect., Fasc. 151, p. 34. [Twenty-one species.]

TYPE: *Chrysidea pumila* (Klug) [= *Chrysis* (*Spintharis*) *pumila* Klug, 1845 = *Chrysidea pumila* (Klug)]. (By original designation.)

Chrysidium Brauns, 1928. Entom. Mitt., XVII, p. 390.

TYPE: *Chrysidium antiquum* Brauns, 1928. (Monobasic.)

Chrysis Linnaeus, 1761. Faun. Suec., Second Edition, p. 414. [Five species.]

TYPE: *Chrysis ignita* (Linnaeus) [= *Sphex ignita* Linnaeus, 1758 = *Chrysis* (*Chrysis*) *ignita* (Linnaeus). (By designation of Latreille, 1810, Consid. Gen., Tab. Meth., p. 437.)

Chrysogona Förster, 1853. Ver. Naturhist. Ver. preuss. Rheinl. u. Westf., X, p. 327.

TYPE: *Chrysogona gracillima* Förster, 1853 [= *Chrysis* (*Chrysogona*) *gracillima* (Förster)]. (Monobasic.)

Chrysura Dahlbom, 1845. Dispos. Meth. Hym., II, p. 6. [Ten species.]

TYPE: *Chrysura austriaca* (Fabricius) [= *Chrysis austriaca* Fabricius, 1805 = *Chrysis* (*Chrysura*) *austriaca* (Fabricius)]. (Type by present designation.)

Cleptes Latreille, 1802. Hist. nat. Crust. & Insect., III, p. 316.

TYPE: *Cleptes semiaurata* (Linnaeus) [= *Sphex semiaurata* Linnaeus, 1761 = *Cleptes semiaurata* (Linnaeus)]. (Monobasic.)

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[4] Semenov, [Rev. Russ. Ent., XII, p. 201, 1912], states that *Platycoelia* Dahlbom, 1845 is preoccupied by *Platycoelia* Dejean, 1833 and places *P. ehrenbergi* Dahlbom (type of *Platycoelia* Dahlbom) in *Cephalochrysis*. However, *Platycoelia* Dahlbom (Dispos. Meth. Hym., II, table of genera, 1845) is merely a typographical error for *Platycelia* Dahlbom (*op. cit.*, p. 8) *q. v.*

Cymura Dahlbom, 1845. Dispos. Meth. Hym., ii, p. 4.

TYPE: *Cymura splendida* Dahlbom, 1845 [= *Hedychrum coelestinum* Spinola, 1838]. (Monobasic.)

Dichrysis Lichtenstein, 1876. Petit. Nouv. Entom., ii, p. 27. [No species.] Mocsary, 1889, Monogr. Chrysid., p. 316. [Four species.]

TYPE: *Chrysis* (*Dichrysis*) *bihamata* (Spinola) [= *Chrysis bihamata* Spinola, 1838 = *Chrysis* (*Dichrysis*) *bihamata* (Spinola)]. (Type by present designation.)

Dictenulus Semenov Tian Shanskij, 1932. Hor. Soc. Ent. Ross., xlii, p. 6. [Sixteen species.]

TYPE: *Ellampus* (*Dictenulus*) *specularis* Semenov, 1932 [= *Omalus* (*Dictenulus*) *specularis* (Semenov)]. (By original designation.)

Diplorrhos Aaron, 1885. Trans. Amer. Ent. Soc., xii, p. 216.

TYPE: *Diplorrhos plicatus* Aaron, 1885. (Monobasic.)

Duckeia Da Costa Lima, 1936. Livre Jubilaire de M. E. L. Bouvier, p. 174.

TYPE: *Duckeia cyanea* da Costa Lima, 1936. (Monobasic.)

Elampos Dahlbom, 1854. Hymen. Europ., ii, p. xv, (fig.)

Typographical error for *Ellampus* Spinola in text figure.

Elampus Spinola, 1806.[5] Ins. Ligurae, i, p. 10. [Five species.]

TYPE: *Elampus panzeri* Fabricius, 1805. (By designation of Latreille, 1810, Consid. Gen., Tabl. Meth., p. 437.)

Isogenotypic with *Ellampus* Agassiz, 1846, and *Notozus* Förster, 1853, *q. v.*

Ellampus Agassiz, 1846. Nomen. Zool., Index Univ., pp. 135, 136.

Emendation for, and isogenotypic with *Elampus* Spinola, 1806, *q. v.*

Euchroeoides Nurse, 1904. Journ. Bombay Nat. Hist. Soc., xvi, p. 23.

TYPE: *Euchroeoides oblatus* Nurse, 1904. (Monobasic.)

Euchroeus Latreille, 1809. Gen. Crust. & Ins., iv, p. 578.

TYPE: *Euchroeus purpuratus* (Fabricius) [= *Chrysis purpuratus* Fabricius, 1787 = *Euchroeus purpuratus* (Fabricius)]. (Monobasic.)

Gaullea Buysson, 1910. Rev. d'Ent., Caen, xxviii, p. 173.

TYPE: *Gaullea argentina* Buysson, 1910. (Monobasic.)

Gonochrysis Lichtenstein, 1876. Petit. Nouv. Entom., ii, p. 27. [Eighteen species.]

TYPE: *Chrysis* (*Gonochrysis*) *albipennis* (Klug) [= *Chrysis albipennis* Klug, 1854 (in Dahlbom) = *Chrysis* (*Hedychrum*) *unicolor* Dahlbom, 1831 = *Spinolia unicolor* (Dahlbom)]. (By designation of Ashmead, 1902, Can. Ent., xxxiv, p. 227.)

Isogenotypic with *Achrysis* Semenov, 1892, *q. v.*

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[5] Cf. footnote 9 under *Notozus* Förster.

Halopyga Tournier, 1878. Mitt. Schweiz. Ent. Ges., v, p. 305.

Typographical error or *lapsus calami* for *Holopyga* Dahlbom, 1854.

Hedychridium Abeille de Perrin, 1878. Diagn. Chrys. Nouv., p. 3.[6] [Two species.]

TYPE: *Hedychridium minutum* (Lepeletier)[6] [= *Hedychrum minutum* Lepeletier, 1806 = *Chrysis ardens* Coquebert, 1801 = *Hedychridium ardens* (Coquebert)]. (Type designated by Ashmead,[5] 1902, Can. Ent., XXXIV, p. 227.)

Hedychrum Latreille, 1802. Hist. Nat. Crust. & Ins., III, p. 317.

TYPE: *Hedychrum lucidulum* Latreille, 1802 [= *Sphex nobilis* Scopoli, 1763 = *Hedychrum nobile* (Scopoli)]. (Monobasic.)

Hedycrum Say, 1825. [In Keating], Narr. Exp. St. Peter's Riv., App., p. 65.

Typographical error or *lapsus calami* for *Hedychrum* Latreille, 1802.

Heptachrysis Mocsary, 1889. Monogr. Chrysid., p. 594.

TYPE: *Chrysis* (*Heptachrysis*) *festina* (Smith) [= *Chrysis festinus* Smith, 1874 = *Chrysis* (*Heptachrysis*) *festina* (Smith)]. (Monobasic.)

Heterochrysis Brauns, 1928. Ent. Mitt., XVII, p. 392.

TYPES: *Chrysidium* (*Heterochrysis*) *braini* Brauns, 1928. (Monobasic.)

Heterocoelia Dahlbom, 1854. Hym. Europ., II, p. 21.

TYPE: *Heterocoelia nigriventris* (Dahlbom) [= *Cleptes nigriventris* Dahlbom, 1845 = *Heterocoelia nigriventris* (Dahlbom)]. (Monobasic.)

Hexachrysis Lichtenstein, 1876. Petit. Nouv. Entom., II, p. 27. [Five species.]

TYPE: *Chrysis* (*Hexachrysis*) *micans* (Rossi) [= *Chrysis micans* Rossi, 1792 = *Chrysis sexdentata* Christ, 1791 = *Chrysis* (*Pyria*) *sexdentata* (Christ)]. (Type by present designation.[7])

[H]olochrysis Rye, 1878. Zool. Record, 1876, XIII, Ins., p. 134.

Emendation for, and isogenotypic with *Olochrysis* Lichtenstein, *q. v.*

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[6] In this paper Abeille describes three varieties of *Hedychridium minutum: homeopathecum, infans*, and *reticulatum*. Since a variety has no nomenclatorial standing, the species must be taken as the type. Ashmead selected *Chrysis ardens* Coquebert, 1801 as the type. Although this name does not appear in the original description of the genus, Dalla Torre's catalogue of the group had appeared previous to Ashmead's designation, and there *H. minutum* Lepeletier, 1806 is listed as a synonym of *H. ardens* Coquebert, 1801. Since Ashmead has followed, with but one exception, the synonymy of Dalla Torre in his designation of genotypes in the Chrysididae, it is safe to assume that Ashmead had seen a copy of Dalla Torre's work and was thus guided in choosing the name for his type.

[7] Ashmead, [1902, Can. Ent. XXXIV, p. 226], designated *Chrysis ignita* Linnaeus, 1758 as type of *Hexachrysis* Lichtenstein. This designation is invalid as *ignita* Linnaeus was not among the species originally included by Lichtenstein in *Hexachrysis*.

Holophris Mocsary, 1890. Termeszetrajzi Fuzetek, XIII, p. 51.

TYPE: *Ellampus* (*Holophris*) *marginellus* Mocsary, 1890. (Monobasic.)

Holopyga Dahlbom, 1845. Dispos. Meth. Hym., II, p. 4. [Three species.]

TYPE: *Holopyga amoenula* Dahlbom, 1845 [=*Chrysis gloriosa* Fabricius, 1793 = *Holopyga gloriosa* (Fabricius)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 227.)

Homalus Saunders, 1873. Trans. Ent. Soc. Lond. 1873, p. 411.

Emendation for and isogenotypic with *Omalus* Panzer, 1801, *q. v.*

Isadelphia Semenov Tian Shanskij, 1902.[8] Rev. Russ. Ent., II, p. 353.

TYPE: *Isadelphia schmiedeknechti* (Mocsary) [= *Parnopes schmiedeknechti* Mocsary, 1900 = *Isadelphia schmiedeknechti* (Mocsary)]. (Monobasic.)

Isogenotypic with *Isadelphus* Semenov, 1901, *nec* Förster, 1868, *q. v.*

Isadelphus Semenov Tian Shanskij, 1901 *nec* Förster, 1868. Rev. Russ. Ent., I, p. 27.

TYPE: *Isadelphus schmiedeknechti* (Mocsary) [= *Parnopes schmiedeknechti* Mocsary, 1900 = *Isadelphia schmiedeknechti* (Mocsary)]. (Monobasic.)

Isogenotypic with *Isadelphia* Semenov, 1902, *q. v.*

Mesitiopterus Ashmead, 1902. Can. Ent., XXXIV, p. 231.

TYPE: *Mesitiopterus kahlii* Ashmead, 1902. (Monobasic.)

Monochrysis Lichtenstein, 1876. Petit. Nouv. Entom., II, p. 27. [Three species.]

TYPE: *Chrysis* (*Monochrysis*) *hybrida* (Lepeletier) [=*Chrysis hybrida* Lepeletier, 1806 = *Chrysis* (*Chrysura*) *hybrida* (Lepeletier)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 226.)

Nemophora Dahlbom, 1854 *nec* Illiger, 1798 *nec* Hübner, 1816. Hym. Europ., II, p. 168.

TYPE: *Nemophora carinata* Spinola (in Dahlbom, 1854) [=*Chrysis carinata* Spinola (in Dahlbom, 1854) *nec* Say, 1828 *nec* Guerin, 1842 = *Chrysis capensis* Mocsary, 1887 = *Chrysis* (*Chrysogona*) *capensis* (Mocsary)]. (Monobasic.)

Notozus Förster, 1853.[9] Verh. Naturhist. Ver. preuss. Rheinl. u. Westf., X, p. 351. [Five species.]

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[8] This name was proposed by Semenov for the genus *Isadelphus* Semenov, 1901, which, however, is preoccupied by *Isadelphus* Förster, 1868.

[9] Richards, [1937, Gen. Names Brit. Ins., Part V, p. 84 and p. 120], proposes that, in view of the confusion which would result from the dropping of *Notozus* Förster, the name *Elampus* Spinola, 1806 be suppressed. I am of the opinion that this would be a highly desirable action since the name *Notozus* Förster has been consistently used for the group of species origi-

TYPE: *Notozus frivaldszkii* Förster, 1853 [=*Hedychrum spina* Lepeletier, 1806 = *Chrysis panzeri* Fabricius, 1805 = *Elampus panzeri* (Fabricius)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 228.)
Isogenotypic with *Elampus* Spinola, 1806.

Odontochrydium Brauns, 1928. Ent. Mitt., XVII, p. 389.

TYPE: *Odontochrydium trautmanni* Brauns, 1928. (Monobasic.)

Olochrysis Lichtenstein, 1876. Petit. Nouv. Entom., II, p. 27. [Thirty-five species.]

TYPE: *Chrysis* (*Olochrysis*) *aerata* (Dahlbom) [=*Chrysis aerata* Dahlbom, 1854 = *Chrysis trimaculata* Förster, 1853 = *Chrysis* (*Chrysura*) *trimaculata* (Förster)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 226.)

Omalus Panzer, 1801. Faun. Ins. Germ., Fasc. 85, nr. 13.

TYPE: *Omalus aeneus* (Fabricius) [=*Chrysis aenea* Fabricius, 1787 = *Omalus aeneus* (Fabricius)]. (Monobasic.)

Parachrysis Gribodo, 1879. Ann. Mus. Civ. Stor. Nat. Genova, XIV, p. 334.

TYPE: *Chrysis* (*Parachrysis*) *longirostris* Gribodo, 1879. (Monobasic.)

Parellampus Semenov Tian Shanskij, 1932. Hor. Soc. Ent. Ross., XLII, p. 7.

TYPE: *Parellampus praeteritorum* Semenov, 1932. (Monobasic.)

Parnopes Latreille, 1796. Prec. Car. Gen. Ins., p. 126. [No species.] Latreille, 1802, Hist. Nat. Crust. & Ins., III, p. 317. [One species.]

TYPE: *Parnopes carnea* (Fabricius) [=*Chrysis carnea* Fabricius, 1775 = *Chrysis grandior* Pallas, 1771 = *Parnopes grandior* (Pallas)]. (Monobasic.)

Parnopidea Brauns, 1903. Ann. Mus. Hungary, I, p. 460.

TYPE: *Parnopidea mocsaryi* Brauns, 1903. (Monobasic.)

Pentachrysis Lichtenstein, 1876. Petit. Nouv. Entom., II, p. 27. [Three species.]

TYPE: *Chrysis* (*Pentachrysis*) *amoena* (Eversmann) [=*Chrysis amoena* Eversmann, 1857 = *Chrysis* (*Pentachrysis*) *amoena* (Eversmann)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 226.)
Isogenotypic with *Teratochrysis* Semenov Tian Shanskij, 1912, *q. v.*

Philoctetes Abeille de Perrin, 1870. Ann. Soc. Linn. Lyon, XXVI, supp., p. 26. [Three species.]

TYPE: *Holopyga* (*Philoctetes*) *cicatrix* Abeille, 1870 [=*Elampus micans* Klug, 1835 = *Philoctetes micans* (Klug)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 228.)

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nally intended by Förster, whereas *Elampus* (and its emendation *Ellampus*) has been variously used to indicate those species placed in *Omalus* Panzer, 1801 or for both *Omalus* and *Notozus* together.

Platycelia Dahlbom, 1845. Dispos. Meth. Hym., II, p. 8.

TYPE: *Platycelia ehrenbergi* Dahlbom, 1845 [= *Chrysis* (*Chrysis*) *ehrenbergi* (Dahlbom)]. (Monobasic.)

Platycoelia Dahlbom, 1845 *nec* Dejean, 1833. Dispos. Meth. Hym., II, Table of Genera.

Typographical error or *lapsus calami* for *Platycelia* Dahlbom, 1845, *q. v.* See also *Cephalochrysis* Semenov, 1909.

Pleurocera Guérin, 1842. Rev. Zool., v, p. 149.

TYPE: *Pleurocera viridis* Guérin, 1842 [= *Chrysis* (*Pleurocera*) *viridis* (Guérin)]. (Monobasic.)

Poeciloechroa Dahlbom, 1854. Hym. Europ., II, p. 236.

TYPE: *Chrysis* (*Poeciloechroa*) *alternans* Klug (in Dahlbom, 1854) [= *Chrysis aurifascia* Brullé, 1846 = *Chrysis* (*Chrysis*) *aurifascia* (Brullé)]. (Monobasic.)

Polyodontus Radoszkowsky, 1877 *nec* Solier, 1849. [In Fedtschenko], Reise in Turkestan, II, p. 27.

TYPE: *Polyodontus stchurovskyi* Radoszkowsky, 1877 [= *Euchroeus stchurovskyi* (Radoszkowsky)]. (Monobasic.)

Protochrysis Bischoff, 1916. Schrift. Phys.-Ökonom. Ges. Konigsberg, LVI, p. 139.

TYPE: *Protochrysis succinalis* Bischoff, 1916. (Monobasic.)

Pseudepyris Ducke, 1902. Zeitschr. Hym. Dipt., II, p. 204.

TYPE: *Pseudepyris paradoxa* Ducke, 1902. (Monobasic.)

Pseudhedychrum Abeille de Perrin, 1878. Ann. Soc. Linn. Lyon, XXVI, suppl., p. 27. [Three species.]

TYPE: *Holopyga* (*Pseudhedychrum*) *fervida* (Fabricius) [= *Chrysis fervida* Fabricius, 1781 = *Holopyga fervida* (Fabricius)]. (Type by present designation.)

Pseudochrysis Semenov Tian Shanskij, 1891. Hor. Soc. Ent. Ross., XXV, p. 444. [Two species.]

TYPE: *Pseudochrysis* (*Spintharis*) *virgo* Semenov, 1891 [= *Pseudochrysis* (*Pseudochrysis*) *virgo* Semenov]. (By designation of Richards, 1935, Trans. Roy. Ent. Soc. Lond., LXXXIII, p. 158.)

Pseudogonochrysis Bischoff, 1910. Mitt. K. K. Zool. Museums, Berlin, IV, p. 448. [Three species.]

TYPE: *Pseudogonochrysis guineensis* (Mocsary) [= *Chrysis* (*Tetrachrysis*)*guineensis* Mocsary, 1889 = *Pseudogonochrysis guineensis* (Mocsary)]. (Type by present designation.)

Pseudohexachrysis Bischoff, 1910. Mitt. K. K. Zool. Museums, Berlin, IV, p. 448.

TYPE: *Pseudohexachrysis splendens* (Dahlbom) [= *Chrysis splendens* Dahlbom, 1854 = *Pseudohexachrysis splendens* (Dahlbom)]. (Monobasic.)

Pseudomalus Ashmead, 1902. Can. Ent., XXXIV, p. 229.

TYPE: *Pseudomalus semicircularis* (Aaron) [= *Omalus semicircularis* Aaron, 1885]. (Monobasic and by original designation.)

Pseudotetrachrysis Bischoff, 1910. Mitt. K. K. Zool. Museums, Berlin, IV, p. 447. [Three species.]

TYPE: *Pseudotetrachrysis oxygona* (Mocsary) [= *Chrysis* (*Tetrachrysis*) *oxygona* Mocsary, 1890 = *Pseudotetrachrysis oxygona* (Mocsary)]. (Type by present designation.)

Pyria Lepeletier & Serville, 1828. Encycl. Meth., X, p. 494. [Four species.]

TYPE: *Pyria armata* Lepeletier & Serville, 1828 [= *Chrysis lincea* Fabricius, 1775 = *Chrysis* (*Pyria*) *lincea* (Fabricius)]. (By designation of Ashmead, 1902, Can. Ent., XXXIV, p. 225.)

Pyrochloris Klug, 1839. Ber. Akad. Wissensch. Berlin, p. 2. [No species.]

Pyrosoma Dahlbom, 1854 *nec* Peron, 1804. Hym. Europ., II, p. 96. [Nomen nudum.]

Spinolaia Schulz, 1906. Spolia Hymenopterologica, p. 154.

Emendation for *Spinolia* Dahlbom, 1854, *q. v.*

Spinolia Dahlbom, 1854. Hym. Europ., II, p. 363.

TYPE: *Spinolia magnifica* Dahlbom, 1854 [= *Chrysis lamprosoma* Förster, 1853 = *Spinolia lamprosoma* (Förster)] (Monobasic.)

Spintharina Semenov Tian Shanskij, 1892. Hor. Soc. Ent. Ross., XVI, p. 485. [Three species.]

TYPE: *Pseudochrysis* (*Spintharina*) *vagans* (Radoszkowsky) [= *Chrysis vagans* Radoszkowsky, 1877 = *Pseudochrysis* (*Spintharina*) *vagans* (Radoszkowsky)]. (By original designation.)

Spintharis Klug, 1845. Symbolae Physicae, plate XLV. [Ten species.]

TYPE: *Chrysis* (*Spintharis*) *humeralis* Klug, 1845 [= *Chrysis pallidicornis* Spinola, 1838 = *Spintharis* (*Spintharis*) *pallidicornis* (*Spinola*)]. (By designation of Richards, 1935, Trans. Roy. Ent. Soc. Lond., LXXXIII, p. 158.)

Stilbichrysis Bischoff, 1910. Mitt. K. K. Zool. Museums, Berlin, IV, p. 448.

TYPE: *Stilbichrysis biselerata* Bischoff, 1910. (Monobasic.)

Stilbum Spinola, 1806. Ins. Ligurae, I, p. 9. [Two species.]

TYPE: *Stilbum calens* Spinola, 1806 [= *Chrysis cyanura* Forster, 1771 =

Stilbum cyanurum cyanurum (Forster) [10]. (By designation of Latreille, 1810, Consid. Gen., Tab. Meth., p. 437.)

Teratochrysis Semenov Tian Shanskij, 1912. Rev. Russ. Ent., xii, p. 198. [Four species.]

TYPE: *Chrysis (Teratochrysis) amoena* (Eversmann) [= *Chrysis amoena* Eversmann, 1857 = *Chrysis (Pentachrysis) amoena* (Eversmann)]. Type by present designation.)

Isogenotypic with *Pentachrysis* Lichtenstein, 1876, *q. v.*

Tetrachrysis Lichtenstein, 1876. Petit. Nouv. Entom., ii, p. 27. [Forty-three species.]

TYPE: *Chrysis (Tetrachrysis) aeruginosa* (Dahlbom) [= *Chrysis aeruginosa* Dahlbom, 1854 = *Chrysis succincta* Linnaeus, 1767 = *Chrysis (Chrysis) succincta* (Linnaeus)]. (By designation of Ashmead, 1902, Can. Ent., xxxiv, p. 226.)

Trichrysis Lichtenstein, 1876. Petit. Nouv. Entom., ii, p. 27.

TYPE: *Chrysis (Trichrysis) cyanea* (Linnaeus) [= *Sphex cyanea* Linnaeus, 1758 = *Chrysis (Trichrysis) cyanea* (Linnaeus)]. (Monobasic.)

Wollmania Mocsary, 1909. Arch. Zool., Budapest, i, p. 2.

TYPE: *Wollmania concinna* Mocsary, 1909. (Monobasic.)

APPENDIX

On Changes in the Nomenclature of the Subgenera of Chrysis

In 1876, J. Lichtenstein published a brief paper [11] in which he gave names of subgeneric rank to the eight "Phalanges" of Dahlbom's Hymenoptera Europaea of 1854. Under each name were listed the species which Lichtenstein knew belonged to the various groups.

During the course of this work on the genotypes certain facts were brought to light which indicate that at least five of the subgeneric names proposed by Lichtenstein are congeneric with earlier names and hence must be relegated into synonymy. These names, because of their descriptive quality, have been of great convenience in the classification of the genus, but this aspect of the situation must be laid aside and the law of priority adhered to if the family is to attain any uniformity in its nomenclature. Moreover, taxonomic studies are now beginning to indicate that these conventional subgenera are probably very unnatural groups of species and that in time when our knowledge of the specific affinities within the genus is more complete it may be necessary to redefine the subgenera with a consequent re-allocation of the various species.

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[10] See Zimmermann, 1937, Arch. Naturgesch., vi, pp. 649-657 for a discussion of the synonymy and varieties of *Stilbum cyanurum* (Forster).

[11] Petites Nouvelles Entomologiques, (Paris), ii, p. 27, (1876).

The five subgeneric names of Lichtenstein which must be changed are as follows:

Olochrysis. Congeneric with *Chrysura,* Dahlbom, 1845.

Gonochrysis. Isogenotypic with *Achrysis* Semenov Tian Shanskij, 1892, which is congeneric with *Spinola* Dahlbom, 1854. Thus Lichtenstein's *Gonochrysis* is not the *Gonochrysis* of authors which is congeneric with and for which Förster's 1853 name, *Chrysogona,* must be used.

Monochrysis. Congeneric with *Chrysura* Dahlbom, 1845.

Tetrachrysis. Congeneric with *Chrysis* Linnaeus, 1761 (*sensu stricto*).

Hexachrysis. Congeneric with *Pyria* Lepeletier & Serville, 1828.

The three remaining subgenera of Lichtenstein, *Dichrysis, Trichrysis,* and *Pentachrysis,* remain unchanged.

NEW SPECIES OF PELLICIA WITH REMARKS ON THE GENUS

(LEPIDOPTERA: HESPERIIDAE)

BY R. C. WILLIAMS, JR. AND ERNEST L. BELL

(Twenty-two text-figures)

PELLICIA Herrich-Schaffer

1870. *Pellicia* Herrich-Schaffer, Correspondenz-Blatt des Zoològ. mineralog. Ver., Regensburg, xxiv, p. 159.

1894. *Pellicia* Godman & Salvin, Biol. Cent.-Amer., Rhopal., ii, p. 367.

LOGOTYPE: *Pellicia dimidiata* Herrich-Schaffer. By Scudder, Proc. Amer. Acad. Arts and Sci., x, (2nd. series, vol. ii), p. 243, 1875. (Historical Sketch of the Generic Names Proposed for Butterflies.)

The considerable number of species now comprising this genus present exceedingly difficult problems of identification. Many of them have the same color and the same form of maculation, differing from each other in such minute degree that the difference cannot be accurately expressed in words. In several species it is extremely doubtful that they can be accurately separated by the superficial comparison of actual specimens and yet the form of the male genitalia radically differs in each species. To identify specimens on the basis of the original descriptions of authors is an utter impossibility.

In this paper a number of species are described as new, after all efforts failed to identify them as any of the species now included in the genus. We have accepted as authentic the determination of species by previous authors where they published a figure of the male genitalia, although we believe that where their determinations were based on superficial comparison, even with actual types, considerable room for error exists. Until the actual types of authors can be examined and the form of the male genitalia determined, in those cases where the type is a male, it is quite impossible for any one to be sure just which species was the basis of the original description. It may be possible that some of the species we are describing as new will turn out to be the same as those described by some of the older authors, if their types can be found and examined but until such time it will be possible to apply a definite name to these insects.

We are accompanying each description of a new species with the figure of the male genitalia of that species in order that they may be readily identified by anyone going to the trouble of examining the male genitalia of their specimens. We are also figuring the genitalia of a few species where no previous figure appears to have been published and we also list the reference to the figures of those species which have been previously published.

The genus was restricted by Godman & Salvin to those species having a hair tuft arising between the costal margin and the costal nervure on the upper side of the secondaries but we believe that this character may be absent in some members of the genus.

In that group of insects within this genus, which we call the *macarius* group, is contained all of the species having the same general appearance, color and form of maculation as *macarius* Herrich-Schaffer and having the same form of the male genitalia but naturally differing in detail in each species. The color is some shade of brown or black which varies in depth among individuals of any one species. There are four dark bands on the primaries, one submarginal, one extra-discal, one discal, one basal. These bands vary in width and may be entire or macular, the extra-discal and discal may be independent or may be fused below the cell, according to the species. The bands may be distinct, or very indistinct, or invisible in the dark individuals and all these variations may be found among individuals of one species in some cases. In this group there are normally from one to three hyaline subapical spots on the primaries.

The secondaries may be somewhat rounded or elongate and usually have three dark bands, one submarginal, one discal, one basal and these vary in distinctness among individuals in the same way as those of the primaries.

In the male genitalia in this group the uncus is usually long and slender, curves downward and terminates in a somewhat blunt point. A scaphium is present, weakly developed in some species and heavily so in others, and the development, but not the form, sometimes varies in individuals of the same species. The aedoeagus is remarkably short in view of the large size of the claspers. The claspers are asymmetrical in all of the species in this group we have been able to examine. Each clasper consists of an upper and lower lobe, the upper lobe broad and the lower lobe less so or slender and either or both lobes may have numerous teeth or small serrations in the apical part.

The left clasper is usually of a more complicated form that the right clasper, although in some species both claspers are complicated in form and in others neither is complicated. The development of the lower lobe varies among individuals as does the terminal parts of each lobe and the size of the teeth and the smaller serrations.

The following nine new species are all members of the *macarius* group.

Pellicia montana new species (Fig. 1.)

Male. Upper side. Resembles *ephora* Herrich-Schaffer. Both wings blackish brown, the bands very indistinct. Primaries with three hyaline subapical spots, the lower one a little the smaller and a little outward of the upper two.

Secondaries elongate, hair tuft short and brown.

Under side Rufous brown with the bands indistinct. Inner marginal area of primaries paler.

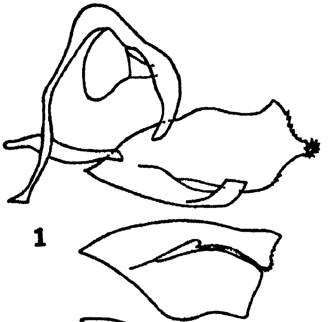
Body, head and palpi above blackish brown, beneath brown. Antennae above black, beneath dark brown.

Expanse: 33 mm.

Type material.—Holotype male; Mt. Duida, Venezuela; [collection of the American Museum of Natural History].

Pellicia guianae new species (Fig. 2.)

Male. Upper side. Resembles *bromias* Godman & Salvin, but the outer margin of the secondaries is a little more evenly rounded. The primaries have three rather small hyaline subapical spots, the lower one very minute and slightly outward of the upper two.



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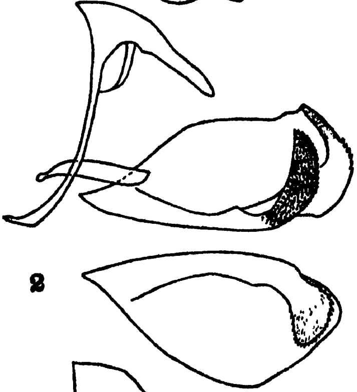

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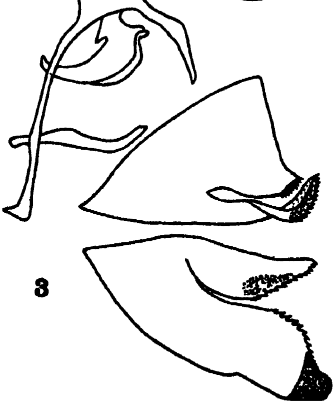

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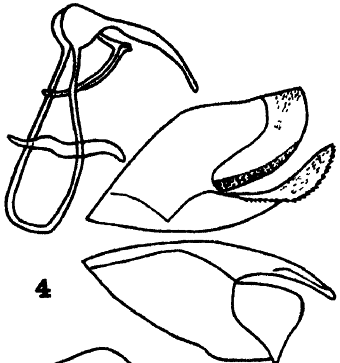

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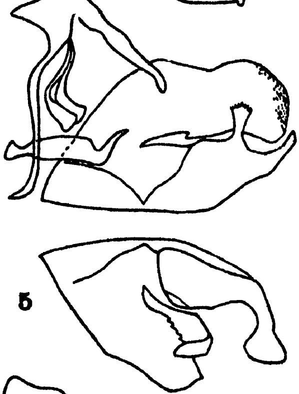

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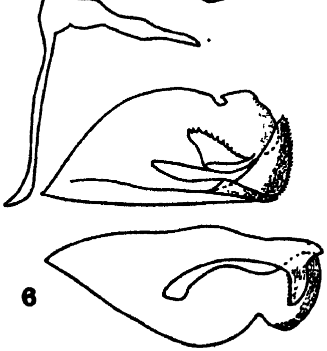

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The specimen from French Guiana has a very narrow submarginal black band and a very broad extra-discal black band, between these two bands is a narrow macular band of rufous brown and there is a very narrow marginal band of the same color. The discal band fuses with the extra-discal band below the cell and at the end of the cell is a short rufous brown stripe. The basal band is barely separated from the broad black area formed by the fusion of the discal and extra-discal bands. The secondaries are blackish with traces of rufous brown spots between the usual dark bands. The costal margin is narrowly paler brown. The hair tuft is dark brown.

Beneath lighter, rufous brown, the subapical spots repeated. The two outer bands of the primaries and all the bands on the secondaries are repeated but narrower and somewhat macular. Inner margin of the primaries pale brown in the basal two-thirds below the cell. On the secondaries there is an oblique dark spot at the anal angle.

Body, head and palpi above blackish, beneath brown. Antennae black above, beneath narrowly brown, the apiculus reddish.

Expanse: 33 mm. in the type; 35 mm. in the paratype.

Type material.—Holotype male; San Laurent du Maroni, French Guiana; [collection of the American Museum of Natural History]. One male paratype; British Guiana; [collection of the Academy of Natural Sciences of Philadelphia].

The specimen from British Guiana is much darker, the bands on the upper side obscured and not traceable. Beneath there is only a mere suggestion of the bands on the secondaries. This specimen more nearly resembles *ephora* than *bromias*.

In this species the scaphium is feebly developed.

Pellicia brunneata new species (Fig. 3.)

Male. Upper side. Resembles *bromias* Godman & Salvin, but somewhat more distinctly marked. On the primaries a narrow, rather macular black submarginal band; a broader extra-discal black band, the upper spots at and below the subapical hyaline spots are elongate and end pointedly outward; a short discal band is fused with the extra-discal band below the cell; a short basal black band. The space between the black bands is rufous brown. Three hyaline subapical spots, the lower one the smaller and a little outward of the upper two.

Secondaries with the basal third of the wings, except above the cell, black, all the rest of the wings is rufous brown; a band of two or three black spots just outside of the black basal area; a submarginal band of small black spots. The hair tuft is long, the outer third yellowish brown, the basal part blackish brown.

Beneath lighter than above. Primaries with the inner marginal area broadly paler and with indistinct darker bands. Secondaries with the usual dark bands narrow but distinct and a blackish spot at the anal angle.

Body on both sides, head, palpi and pectus brown. Antennae black above and brown beneath, the club reddish.

Expanse: 32 mm.

Type material.—Holotype male; Port Laurent, French Guiana; [collection of the Academy of Natural Sciences of Philadelphia].

In this species the scaphium is very heavily developed.

Pellicia potera new species (Fig. 4.)

Male. Upper side. Resembles *ephora* Herrich-Schaffer. Ground color of both wings rufous brown, the black bands narrow. Primaries have three hyaline subapical spots, the lower one slightly outward of the upper two and sometimes barely visible on the upper side. The submarginal black band is macular. In some specimens the black bands are less distinct than in others. The hair tuft of the secondaries is very long and pale brown.

Under side. Pale rufous brown. Primaries with the bands of the upper side hazy; a pale spot at the apex; inner margin pale brown. Secondaries with the dark bands macular; a pale transverse bar in the cell; a blackish spot at the anal angle may be present or absent.

Body on both sides, head, palpi and pectus brown. Antennae above black, paler beneath.

Expanse: 25 mm. to 32 mm.

Type material.—Holotype male; East Colombia and three male paratypes: East Colombia; Potero, British Guiana; and Mazurini, Kartabo, British Guiana; [collection of Academy of Natural Sciences of Philadelphia]. One male paratype; Bartica, British Guiana: two male paratypes, Mt. Duida, Venezüela; [collection of American Museum of Natural History].

In this species the scaphium is slender but well developed and there is less asymmetry in the claspers.

Pellicia indistincta new species (Fig. 5.)

Male. Upper side. Resembles a dark *macarius* Herrich-Schaffer except that the hyaline subapical spots are in a straight line. Both wings blackish brown, the bands very indistinct. Three hyaline subapical spots on the primaries, somewhat elongate, of equal size, and in an outwardly oblique straight line. A very minute hyaline dot in interspace 5 and a trace of another one in interspace 4, one over the other and under the lower subapical spot. The hair tuft of the secondaries is of moderate length and brown.

Under side. Primaries rufous brown, the bands indistinct; the inner margin paler; a pale subapical spot. Secondaries in the costal and basal areas the same color as the primaries, the rest of the wings much paler, the bands macular and more distinct, the spots of the two inner bands with paler centers, the submarginal band ill-defined.

Body, head and palpi above blackish brown, beneath brown, pectus brown. Antennae black above, paler beneath.

Expanse: 35 mm.

Type material.—Holotype male; East Colombia; [collection of Academy of Natural Sciences of Philadelphia].

In this species the scaphium is well developed.

Pellicia laurentina new species (Fig. 6.)

Male. Upper side. Resembles the previously described *indistincta* in having the three hyaline subapical spots of the primaries in an outwardly oblique straight line but they decrease in size from that on the costal margin downward, the upper two are elongate and the lower one nearly round. The dots in interspaces 4 and 5 in *indistincta* are absent. The secondaries are more elongate.

Primaries with the bands very indistinct. Hair tuft of the secondaries short and brown.

Under side. Dark rufous brown. Primaries with only a hazy suggestion of the dark bands; the inner margin but slightly paler. Secondaries with the dark bands narrow, macular and very indistinct, a darker spot at the anal angle.

Body, head and palpi above blackish brown, beneath brown; pectus brown. Antennae blackish on both sides, the club beneath a little paler.

Expanse: 35 mm.

Type material.—Holotype male; St. Laurent du Maroni, French Guiana; [collection of American Museum of Natural History].

The uncus is shorter than in *indistincta* and no scaphium shows in the slide of the genitalia but possibly it may have been lost in preparation.

Pellicia haywardi[1] new species (Fig. 7.)

Male. Upper side. Somewhat resembles *castolus* Hewitson. Primaries brown, a thin submarginal black band; a little wider extra discal black band; a narrow discal band fusing with the previous band at vein 2; a short basal band. None of the bands are very distinct. Three hyaline

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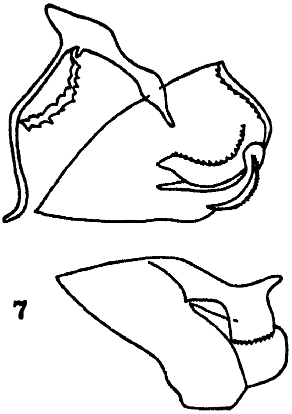
[1] Named for Mr. Kenneth J. Hayward, Concordia, Argentina.



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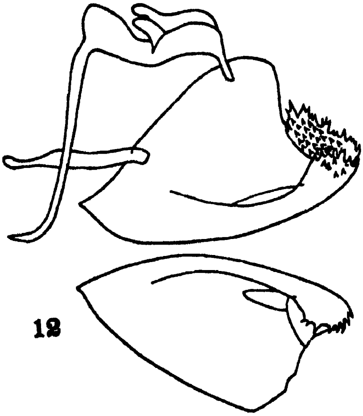

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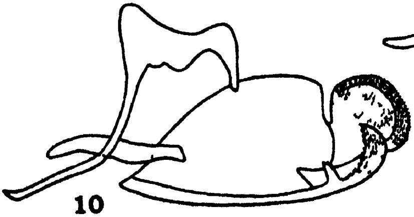

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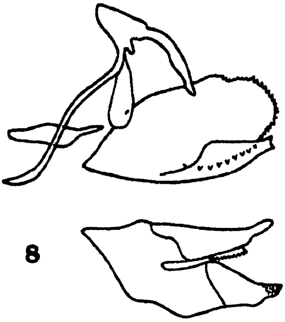

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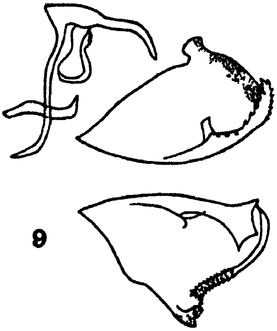

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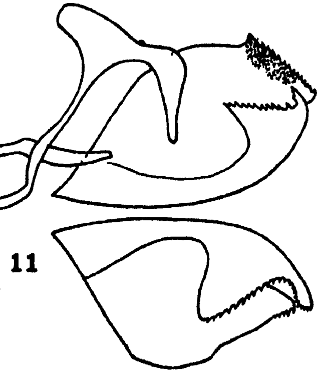

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subapical spots, the lower one very minute, just under the outer corner of the middle one. Secondaries with the bands very indistinct. Hair tuft of the secondaries of moderate length and brown.

Under side. Paler than above. Primaries with the dark bands very indistinct; the inner margin paler. Secondaries with indistinct bands; the two spots of the discal band above the abdominal fold have slightly paler centers.

Body on both sides, head, palpi and pectus brown. Antennae blackish above, pale brown beneath, apiculus red beneath.

Expanse: 28 mm. to 31 mm.

Type material.—Holotype male; Capilla del Monte, Cordoba, Argentina: one male paratype; La Rioja, Argentina; [collection of the American Museum of Natural History].

In this species the scaphium is heavily developed.

Pellicia peruana new species (Fig. 8.)

Male. Upper side. Resembles *nyctineme* Butler but a little darker and the secondaries a little less elongate. Both wings dark brown. Primaries with indistinct black bands, the submarginal thin and macular; the discal fused with the submarginal on vein 2. Three small hyaline subapical spots, the lower one a little outward of the two upper ones. Secondaries with indistinct black bands. Hair tuft very short and brown.

Under side. Rufous brown, paler than above, the dark bands of both wings a little more distinct. Inner margin of the primaries paler and a pale spot at the apex.

Body, head and palpi above dark brown, beneath, with the pectus, brown. Antennae black above, beneath brown.

Expanse: 27 mm. to 29 mm.

Type material.—Holotype male and three male paratypes; Putumayo River region, Peru; [collection of American Museum of Natural History].

In this species the scaphium is very feeble.

Pellicia alternata new species (Fig. 9.)

Male. Upper side. Very similar in color and maculation to the previously described *peruana,* differs on the upper side in that the discal and extra-discal bands do not fuse; the subapical hyaline spots are more nearly in a straight line; the hair tuft of the secondaries is paler brown. On the under side the pale inner marginal area of the primaries is more extensive and the lower spots of the discal band of the secondaries have slightly paler centers.

Head, body, palpi and pectus as in *peruana*. Antennae black above, brownish beneath, the apex of the club and the apiculus reddish.

Expanse: 27 mm.

Type material.—Holotype male; Leticia, Peru; [collection of American Museum of Natural History].

The scaphium is a little more developed than in *peruana*.

In the following group, which we call the *costimacula* group, there is contained those species which resemble *costimacula* Herrich-Schaffer in the form of maculation and genitalia.

There are usually the four dark bands on the primaries but often some of these are so obscured that they appear to be absent. The discal and extra-discal bands are fused, or would fuse if the discal band was continued far enough, at some point below the cell. There is usually more or less violet suffusion in the costal, apical and basal areas of the primaries, but this suffusion is very faint or absent in some species. There are no hyaline subapical spots. The secondaries usually have three dark bands, marginal, discal and basal, but these may at times be almost totally obscured.

The closely allied species in this group present an almost, if not quite, impossible problem of superficial distinction, but the form of the male genitalia is radically different in each.

The uncus is bulbous near the middle and the apical part is directed downward. The scaphium appears to be very feebly developed in this group. The aedoeagus is a little longer than in the *macarius* group. The claspers are asymmetrical in some species, in others there is very little asymmetry. In this group there is the same variation in individual development as is found in the *macarius* group.

The following six new species are all members of the *costimacula* group.

Pellicia klugi[2] new species (Fig. 10.)

Male. Upper side. Resembles *costimacula* Herrich-Schaffer but is slightly larger and the secondaries are blacker. The same violet areas and the same dark bands on the primaries. The secondaries are very black so there is only the faintest suggestion of bands, in *costimacula* the bands, while not very distinct, are a little more traceable; the costal margin is narrowly pale brown. The hair tuft is as in *costimacula*.

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[2] Named for Mr. G. Klug, of Iquitos, Peru.

Beneath paler brown with a slight violet reflection. On the primaries the apical area, the basal area below the cell and the inner margin are pale brown; the bands of the upper side faintly visible. Secondaries with the costal area above the cell darker than the rest of the wings; the usual bands present and somewhat macular, the submarginal sometimes forming a dark spot at the anal angle.

Body, palpi, pectus, antennae as in *costimacula*.

Expanse: 34 mm. to 37 mm.

Type material.—Holotype male and two male paratypes; Putumayo River region, Peru: one male paratype; Iquitos, Peru; [collection of American Museum of Natural History].

Pellicia santana new species (Fig. 11.)

Male. Upper side. Of the size and appearance of *costimacula* Herrich-Schaffer. On the primaries with the same violet areas and dark bands. Secondaries very black, the bands faintly visible, the costal margin brown; the hair tuft dark brownish.

Beneath lighter brown. Primaries with apex, basal area below the cell pale brown and inner margin very pale grayish brown. Bands of the upper side faintly visible. Secondaries with the costal third darker than the rest of the wings which is pale brown; the usual darker bands are visible but not very distinct.

Body, head and palpi as in *costimacula*.

Expanse: 33 mm.

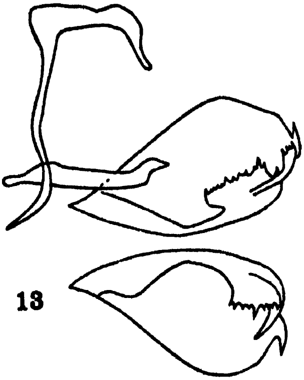
Type material.—Holotype male; San Antonio, Peru: one male paratype; Peru; [collection of American Museum of Natural History].

Pellicia simulator new species (Fig. 12.)

Male. Upper side. Same size and appearance of *costimacula* and *santana*, slightly smaller than *klugi*. All of the characters of maculation of both sides of the wings and the body and its appendages are the same as in *santana*, except that there is a more pronounced submarginal dark spot near the anal angle of the secondaries beneath and the pale basal and inner marginal areas of the primaries are a little brighter and more extensive, occupying nearly all of the space from the base to the outer margin below vein 2.

Expanse: 33 mm.

Type material.—Holotype male; Putumayo River region, Peru; one male paratype; Iquitos, Peru; [collection of American Museum of Natural History].



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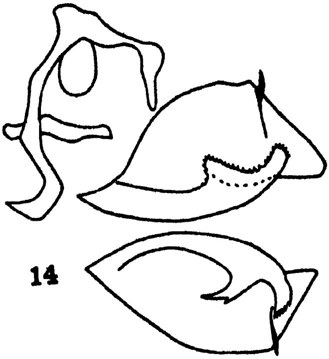

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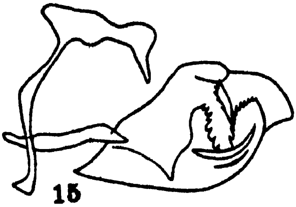

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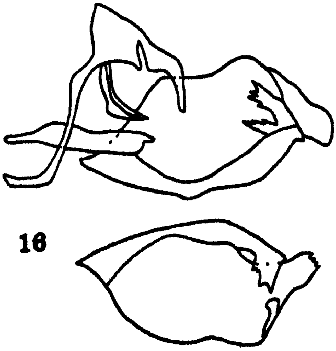

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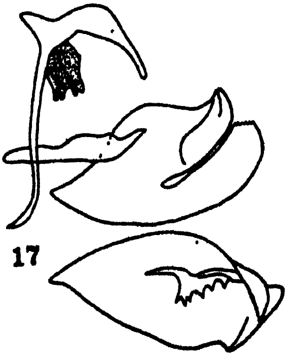

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Pellicia aequatoria new species (Fig. 13.)

Male. Upper side. In size and appearance most closely resembling *vecina* Schaus, from which it differs in being somewhat lighter in color and the dark bands of both wings being more plainly visible.

Under side. On the primaries the submarginal and extra-discal bands are dimly visible; the inner margin below vein 1 is whitish and the basal area of interspace 2 is pale brown but not so pale as in *vecina.* There is a thin bluish overscaling on the costal margin at the apex of the wing and along the outer margin. Secondaries have the abdominal fold overscaled with pale bluish white and all the anal area of these wings below vein 4 is overscaled with this color and it extends along the outer edge of the basal band; the submarginal and discal bands are macular and very distinct where they cross the bluish white area. In the specimens we have of *vecina* the abdominal fold is gray and the anal area is less overscaled with a darker tint of bluish which is not as extensive as in *aequatoria* and the dark bands are not as distinct.

The palpi and pectus are grayish brown and not bluish gray as in *vecina.* Body, head and palpi above brown; thorax beneath grayish brown. Antennae as in *vecina.*

Expanse: 34 mm.

Type material.—Holotype male; Ecuador; [collection of American Museum of Natural History].

Pellicia nema new species (Fig. 14.)

Male. Upper side. Size and appearance of *meno* Mabille but differs in the violet areas of the primaries being very feeble or entirely lacking. The hair tuft of the secondaries is short and brown.

Under side. Differs from *meno* in lacking the light anal area of the secondaries, although it is possible that some individuals of *meno* may lack this light area. On the primaries the bands of the upper side are plainly visible; the inner margin and the basal half of interspace 2 are whitish; a hazy pale spot at the apex. On the secondaries the costal half is dark brownish, the anal half paler brown, varying individually in exact tone. Bands of the upper side visible and sometimes an oblique dark spot at the anal angle.

Body, head and palpi above brown; beneath palpi and pectus gray, thorax with gray hairs, abdomen brown with a darker stripe in the center.

Expanse: 28 mm. to 29 mm.

Type material.—Holotype male and six male paratypes; Chapada, Matto Grosso, Brazil; one male paratype; East Colombia; [collection of Academy of Natural Sciences of Philadelphia].

The upper lobe of each clasper is much the same but the lower lobes are quite different.

Pellicia chapada new species (Fig. 15.)

Male. Upper side. Very similar to *meno* Mabille and to the previously described *nema*, the violet areas more as in *meno* and much more prominent than in *nema*. Differs from both *meno* and *nema* in having no hair tuft on the secondaries.

Under side. Primaries along the costal margin in the apical area there is a violet tinge and sometimes a light overscaling of pale violet. The secondaries are purplish brown, slightly paler in the anal third and in this paler area the somewhat macular dark bands are more plainly visible. In some individuals in the anal area there is an overscaling of pale violet between the dark bands and in the abdominal fold.

Body, head and palpi above brown; beneath thorax, palpi and pectus grayish brown. Antennae brown above, beneath grayish, the apiculus reddish.

Expanse: 28 mm. to 29 mm.

Type material.—Holotype male and seven male paratypes; Chapada, Matto Grosso, Brazil; one paratype, Corumba, Matto Grosso, Brazil; [collection of Academy of Natural Sciences of Philadelphia].

There is practically no asymmetry in the claspers of the male genitalia.

The following two species do not belong to either the *macarius* group or the *costimacula* group.

Pellicia brasiliensis new species (Fig. 16.)

This species does not closely resemble any of the other species with which we are familiar but probably comes closer to *castolus* in general habitus than any of the others. It differs from *castolus* in having no hyaline subapical spots and in not having pale centers in the spots of the bands on the under side of the secondaries.

Male. Upper side. Primaries brown, no hyaline subapical spots. The usual four dark bands, the submarginal macular, the extra-discal and discal fused below the cell, and all more or less distinct. Secondaries somewhat darker than the primaries with the usual bands less distinct. Hair tuft short, brown at the base, the rest blackish.

Beneath a little paler than above. Primaries with inner margin and basal area below the cell whitish. A small grayish spot at the apex. The bands of the upper side more or less distinct; between the submarginal and extra-discal bands are some dimly grayish spots between the veins. Secondaries in the anal third grayish white or grayish brown between the marginal and discal, and the discal and basal bands. At the anal angle a large and prominent black spot at the end of the submarginal black band.

Body, head and palpi above brown. Beneath the palpi are white or sordid white; the pectus and thorax pale brownish or grayish brown; the abdomen pale brown with a dark stripe in the center. Antennae black above, beneath brown.

Female. Similar to the male, the wings more rounded. On both wings the dark bands are broader, the submarginal is continued to the border of the wing and is less macular than in the male. On the under side the basal area below the cell is not as pale but the inner margin is more purely white than in the male and the marginal dark band is bordered internally by a line of spots, the lowest of which is white and those above are grayish and smaller. The white anal area of the secondaries is more purely white; a white ray extends outward on vein 2 to the margin and another very thin ray extends to the margin along the inner edge of the abdominal fold; the black anal spot is prominent. There is a small grey spot at the end of each vein in the lower half of the wings. At the anal angle the base of the fringes is grayish.

Body, head and palpi above as in the male; beneath the palpi and pectus are white, thorax grayish, abdomen yellowish white with a thin brown central line.

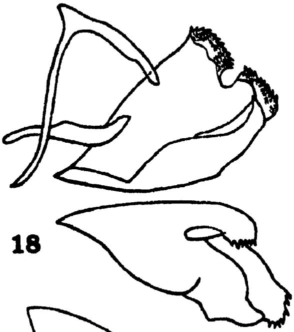
Expanse: male, 25 mm. to 28 mm.; female 30 mm.

Type material.—Holotype male; Minas Geraes, Brazil; [collection of Academy of Natural Sciences of Philadelphia]. Allotype female and one male paratype; Para, Brazil; one male paratype, Brazil; [collection of American Museum of Natural History].

The uncus is rather long and differs in shape from that of the *macarius* group. The scaphium is well developed. The claspers are only slightly asymmetrical.

Pellicia diversa new species (Fig. 17.)

Male. Upper side rufous brown. Primaries with a very narrow submarginal band, extra-discal and discal bands fusing below the cell, a basal band, all blackish brown and indistinct. Three hyaline subapical spots, the lower one a little outward of the upper two; a small hyaline spot in interspace 2 just above the center of vein 2; another small one just below vein 2 and a little inward of the first one. Fringes concolorous.



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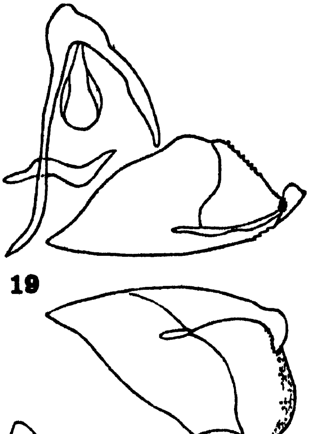

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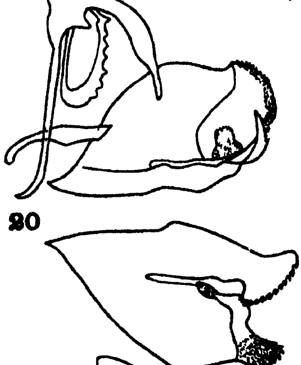

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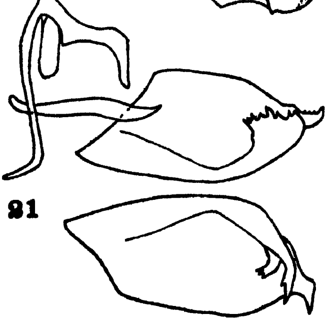

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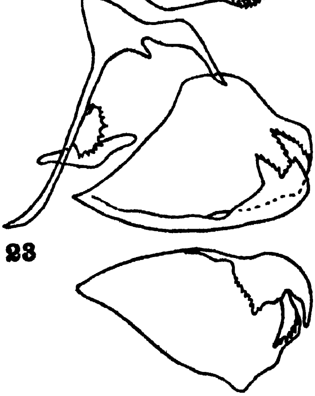

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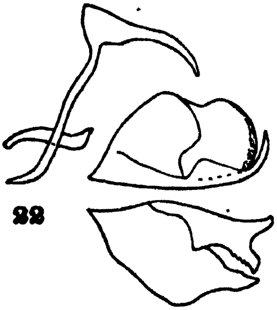

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Secondaries with a fairly broad marginal band and discal and basal bands, all blackish brown and not prominent. Basal area, along the abdominal fold and just above it with long brown hairs. The secondaries are not as elongate as in most of the *Pellicia* and the outer margin is somewhat convex between veins 2 and 6.

Under side. Primaries paler, rufous brown, the inner margin still paler; a small grayish apical spot. The hyaline spots of the upper side are repeated and there is a small whitish spot near the base of interspace 2, just under the cell. Thin, irregular, gray overscaling along the outer margin from vein 3 to the anal angle. Secondaries with the area between the basal and discal bands a little paler than the rest of the wings. The abdominal fold with gray hairs and a thin, irregular, overscaling of gray along the outer margin of the wings from near vein 6 to the anal angle and extending on the base of the fringes. The bands of the upper side are present but indistinct.

Body, head and palpi above rufous brown; beneath thorax, abdomen, palpi and pectus are gray. Antennae black above, beneath blackish brown.

Expanse: 29 mm.

Type material.—Holotype male; Buenavista, Santa Cruz, Bolivia; [collection of Academy of Natural Sciences of Philadelphia].

Although this insect differs somewhat from the usual form found in *Pellicia* the male genitalia indicate the close relationship with that genus.

We figure the male genitalia of the following six species as figures for them do not seem to have been previously published.

Pellicia alicus Schaus (Fig. 18.)

1902. *Staphylus alicus* Schaus, Proc. U. S. Nat. Mus., XXIV, p. 433. [Southeast Brazil.]

The specimen from which the figure is made came from southeast Brazil and was determined as *alicus* by comparison with the type.

Pellicia bipuncta Schaus (Fig. 19.)

1902. *Pellicia bipuncta* Schaus, Proc. U. S. Nat. Mus., XXIV, p. 430. [Petropolis, Nova Friburgo, Brazil.]

The figure is from a specimen from southeast Brazil, determined as *bipuncta* by superficial comparison with the type.

Pellicia gonoptila Burmeister (Fig. 20.)

1879. *Helias gonoptila* Burmeister, Descr. Phys. Rep. Argentina, v, p. 260. [Buenos Aires.]

The range of *gonoptila* extends well into the northern part of South America, our figure is from a specimen from Peru which agrees with others we have from Argentina. The species is quite variable in the ground color of the wings.

Pellicia meno Mabille (Fig. 21.)

1889. *Arteurotia meno* Mabille, Le Naturaliste, (2), III, p. 239. [Panama.]

Our figure is from a specimen from the Canal Zone, Panama. The form of the male genitalia is very similar to that of *costimacula*, from which *meno* may be superficially separated by its smaller size, lighter upper surface of the primaries, against which the dark bands are better defined, and the whitish anal area of the secondaries beneath. We have two specimens, one from Panama and one from Bolivia, which lack the whitish anal area of the secondaries but otherwise cannot be distinguished from *meno* in either the form of maculation or genitalia. These may be a very closely allied species or merely a form of *meno*.

Pellicia nyctineme Butler (Fig. 22.)

1877. *Achlyodes nyctineme* Butler, Trans. Ent. Soc. London, 1877, p. 155. [Rio Trombetas, Para, Brazil.]

Our figure is from a Brazilian specimen.

Pellicia vecina Schaus . (Fig. 23.)

1902. *Pellicia vecina* Schaus, Proc. U. S. Nat. Mus., XXIV, p. 430. [Petropolis, Brazil.]

Our figure is from a specimen from Massaranduba-Blumenau, Santa Catharina, Brazil, determined as *vecina* by superficial comparison with the type.

Listed below in alphabetical order are the species of *Pellicia* of which previous authors have published figures of the male genitalia and a reference is given to a publication in which a figure will be found.

Pellicia (?) achates Bell

1937. Amer. Mus. Novit., no. 914, p. 7; p. 3, fig. 6. [Mapiri.]

Pellicia binotata Hayward

1934. Rev. Soc. Ent. Argentina, VI, p. 209, pl. xx, figs. 7, 9. [Misiones, Argentina.]

Pellicia bromias Godman & Salvin

1894. Biol. Cent. Amer., Rhop., II, p. 370, pl. 83, fig. 14. [Mexico; Guatemala; Costa Rica; Panama.]

Pellicia castolus Hewitson

1878. *Arteurotia castolus* Hewitson, Annals & Mag. Nat. Hist., (5), I, p. 347. [Brazil.]

1894. *Pellicia nyctineme* Godman & Salvin (not Butler), Biol. Cent. Amer., Rhop., II, p. 370, pl. 83, fig. 12.

Pellicia costimacula Herrich-Schaffer

1870. Correspondenz-Blatt des zoolog.-mineralog. Ver., Regensburg, XXIV, p. 160. [Venezuela.]

1894. Godman & Salvin, Biol. Cent-Amer., Rhop, II, p. 370, pl. 83, fig. 18.

Pellicia (?) damon Bell

1937. Amer. Mus. Novit., no. 914, p. 6; p. 3, fig. 4. [Manicore, Brazil.]

Pellicia dimidiata Herrich-Schaffer

1870. Correspondenz-Blatt des zoolog.-mineralog. Ver., Regensburg, XXIV, p. 160. [Mexico, La Guayra.]

1894. *Pellicia didia* Moschler, Godman & Salvin, Biol. Cent. Amer., Rhop., II, p. 371, pl. 83, fig. 21.

Pellicia ephora Herrich-Schaffer

1870. Correspondenz-Blatt des zoolog.-mineralog. Ver., Regensburg, XXIV, p. 160. [Nicaragua and Brazil.]

1894. *Pellicia tiphys* Godman & Salvin, Biol. Cent.-Amer., Rhop., II, p. 368, pl. 83, fig. 8.

Pellicia inca Lindsey

1925. Bull. Denison Univ., XXI, p. 80, pl. xxviii, fig. 5. [Puerto Bermudez, Rio Pichis, Peru.]

Pellicia licisca Ploetz

1882. Berlin Ent. Zeit., xxvi, p. 254. [Nicaragua.]

1901. Godman & Salvin, Biol. Cent.-Amer., Rhop., II, p. 637.

1894. *Pellicia thyestes* Godman & Salvin, Biol. Cent.-Amer., Rhop., ii, p. 372, pl. 83, fig. 27.

Pellicia macarius Herrich-Schaffer

1870. Correspondenz-Blatt des zoolog.-mineralog. Ver., Regensburg, xxiv, p. 160. [Venezuela, Surinam.]

1894. *Pellicia macareus* Godman & Salvin, Biol. Cent.-Amer., Rhop., ii, p. 369, pl. 83, fig. 11.

In the insects which we consider to be *macarius,* there seems to be more variation in the development of the lower lobe of the left clasper than is found in the other species in the genus. Individuals from Central American localities, especially from the northern part of the range, average smaller in size than those from more southern localities, and from South America, and agree in the form of the genitalia with the figure given by Godman and Salvin in having the lower lobe of the left clasper approximately as long as the upper lobe. Individuals from Colombia, agreeing in all other respects except a somewhat larger size, have the lower lobe a little shorter or very short and from all other South American localities from which we have material the lobe is very short. In view of the agreement of the other characters we consider this difference in the lower lobe to be an intra-specific development.

Macarius also presents considerable variation in color, in some individuals the color of the upper surface is paler brown than in others, with distinct darker bands, but the color ranges all the way to a deep blackish brown, against which the dark bands are invisible. The under side of the wings is also subject to a wide range of depth of color.

Pellicia minor Hayward

1933. Rev. Soc. Ent. Argentina, v, p. 230, pl. xix, fig. 8. [Buenos Aires.]

Pellicia najoides Hayward

1933. Rev. Soc. Ent. Argentina, v, p. 231, pl. xix, fig. 9. [Misiones Argentina.]

Pellicia nebula Bell

1937. Amer. Mus. Novit., no. 914, p. 5; p. 3, fig. 3. [New Bremen, Santa Catharina, Brazil.]

Pellicia (?) **phintias** Bell

1937. Amer. Mus. Novit., no. 914, p. 7; p. 3, fig. 5. [Iquitos, Peru.]

Pellicia polyctor Prittwitz

1868. *Pirgus polyctor* Prittwitz, Stet. Entom. Zeitung, xxix, p. 186. [Corcovado.]

1894. *Pellicia polyctor* Godman & Salvin, Biol. Cent.-Amer., Rhop., II, p. 373, pl. 83, fig. 30.

Pellicia subostrina Hayward

1933. Rev. Soc. Ent. Argentina, v, p. 230, pl. xix, fig. 7. [Bueños Aires; Tafi Viejo, Argentina.]

Among our material we either lack specimens or are unable to identify any of them as any of the following species which have been placed in this genus by other authors or by ourselves. It may be possible that some of them are really not members of the genus.

Pellicia albangula Herrich-Schaffer

1870. Correspondenz-Blatt des zoolog.-mineralog. Ver., Regensburg, xxiv, p. 160. [Guatemala]

Pellicia angulosus Mabille

1895. *Nisoniades angulosus* Mabille, Ann. Soc. Ent. France, 1895, Bull., p. lvii. [Santa Catharina.]

We have included *angulosus* in this genus as the characters of maculation given in the original description agree with those found in this genus and the statement that there is a hair tuft above vein 7 on the upper side of the secondaries.

Pellicia bessus Moschler

1877. Verhandl. der k. k. zoolog.-botan. Gesells., Wien, xxvi, 1876, p. 341, pl. 4, fig. 25. [Surinam.]

Moschler stated that his description was based on a female specimen. The association of the sexes in those species having a close superficial appearance is extremely problematical when actual specimens are before one and to do so from a printed description is impossible. His figure of *bessus* is not at all helpful in identifying the species.

Pellicia bobae Weeks

1906. *Pamphila bobae* Weeks, Entomo. News, XVII, p. 203. [Suapure, Venezuela.]
1911. *Pamphila bobae* Weeks, Illus. Diurnal Lepid., II, p. 11, pl. 7, fig. 1.
1933. *Pellicia bobae* Bell, Entom. News, XLIV, p. 265.

The figure published by Weeks shows an insect very similar to *dimidiata* Herrich-Schaffer and the name may possibly be a synonym of *dimidiata.*

Pellicia criton Mabille

1897. Ann. Soc. Ent. France, 1897, p. 192. [Bolivia.]

Pellicia demetrius Ploetz

1882. *Arteurotia demetrius* Ploetz, Berliner Entom. Zeits., XXVI, p. 255. [Brazil.]
1903. *Pellicia demetrius* Mabille, Gen. Insectorum, fasc. 17, Hesp., p. 59.

Pellicia maura Mabille & Boullet

1916. Bull. Soc. Ent. France, 1916, p. 322. [Brazil.]

Pellicia meris Ploetz

1886. *Arteurotia meris* Ploetz, Stett. Entom. Zeitu., XLVII, p. 87. [Colombia.]
1907. *Pellicia meris* Godman, Ann. & Mag. Nat. Hist., (7), XX, p. 151.

Pellicia mimas Cramer

1779. *Papilio mimas* Cramer, Papillons Exotiques, I, p. 83, pl. 52, figs. E, F. [Surinam.]
1882. *Pellicia mimas* Ploetz, Berliner Entom. Zeits., XXVI, p. 254.

Ploetz placed *mimas* in this genus, however, neither the description nor the figure by Cramer is at all enlightening as to the identity of the insect.

Pellicia olinda Strand

1920. Archiv f. Naturg., LXXXVI, A 7, p. 146. [Brazil.]

Pellicia pericles Mabille

1903. Gen. Insect., fasc. 17, Hesp., p. 59. [Bolivia.]

The description of *pericles* agrees very well with *Mycteris cambyses* Hewitson [3] and it seems possible that both names may refer to the same insect, as both types came from Bolivia. If such is the case *pericles* would become a synonym of *cambyses.*

Pellicia rhamses Mabille & Boullet

1916. Bull. Soc. Ent. France, 1916, p. 323. [Panama; Peru; Amazon.]

Pellicia ruda Mabille & Boullet

1916. Bull. Soc. Ent. France, 1916, p. 323. [French Guiana; Brazil; Argentine; Para.]

Pellicia subviolaceus Mabille

1883. *Anastrus subviolaceus* Mabille, Bull. Soc. Ent. Belg., XXVII, C. R. p. liv. [Brazil]

1903. *Pellicia subviolacea* Mabille, Gen. Insect., fasc. 17, Hesp., p. 59.

Pellicia theon Ploetz

1882. Berliner Entom. Zeits., XXVI, p. 255. [South America.]

Pellicia violacea Mabille

1891. Ann. Soc. Ent. Belg., XXXV, C. R. p. lxxvi. ["Patria?"]

Pellicia zamia Ploetz

1882. Berliner Entom. Zeits., XXVI, p. 255. [South America]

Pellicia capitans Schaus

1902. Proc. U. S. Nat. Mus., XXIV, p. 430. [Aroa, Venezuela.]

Dr. Schaus has placed this in the U.S.N.M. collection under *chlorocephala* Herrich-Schaffer, (*chlorocephala* Auct. not Latrielle), originally described in the Genus *Pellicia* but now placed in *Gorgopas.*

Staphylus conjuncta Riley

1929. Bull. Hill Mus., III, p. 136, fig. 3 (clasper). [Southern Matto Grosso, Brazil.]

The shape of the clasper indicates that this may be a *Pellicia* without the hair tuft, rather than a *Pholisora.*

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[3] *Arteurotia cambyses* Hewitson, Ann. & Mag. Nat. Hist., p. 347, 1878. [Bolivia.]

Achlyodes nivonicus Ploetz, (Keferst ms.)

1884. Jahrb. Nass. Ver. Nat. Wiesbaden, xxxvii, p. 14. [Mexico.]

Godman, followed by Draundt, places this as the probable female of *dimidiata* H.-S. Lindsey[4] places it as a good species.

The following names have been placed in the synonymy by various authors under specific names previously mentioned.

Under *bessus* Moschler.

1882. *Pellicia trigeminus* Ploetz (H-S. ms.), Berlin Ent. Zeit., xxvi, p. 254. [Put by the author under *bessus* Mosc. A nomen nudum.]

1904. (*Pellicia*) *sordidulus* Mabille, in Wyts. Gen. Ins. Hesp., p. 59. [Put by the author under *bessus* Mosc. A nomen nudum.]

Under *bromias* Godman & Salvin.

1916. *Pellicia bromias* var. *clara* Mabille & Boullet, Bull. Soc. Ent. France, 1916, p. 323. [French Guiana, Brazil and Argentine.]

1916. *Pellicia bromias* var. *nigra* Mabille & Boullet, Bull. Soc. Ent. France, 1916, p. 323. [Brazil, Argentine, Colombia, Guiana and Bolivia.]

Under *costimacula* Herrich-Schaffer.

1901. *Achlyodes guilfordi* Weeks, Proc. New England Zool. Club, ii, p. 106. [Coroico, Bolivia.]

1905. *Achlyodes guilfordi* Weeks, Ill. Diur. Lep., p. 94, pl. 41, fig. 1.

Under *dimidiata* Herrich-Schaffer.

1889. *Pellicia bilinea* Mabille, Le Natur., xi, ann. p. 216, fig. 3. [Chiriqui. Godman & Salvin place this as the female of *didia* Mosc. (*dimidiata* H.-S.).]

1882. *Pellicia corinna* Ploetz, Berlin Ent. Zeit., xxvi, p. 254. [He sinks *dimidiata* to it.]

Under *ephora* Herrich-Schaffer.

1876. *Pellicia rubescens* Moschler (Prittwitz ms.), Verh. Zool. Bot. Ges. Wien, xxvi, p. 340, pl. 4, fig. 29. [Surinam and Brazil. Ploetz puts this under *ephora* H.-S., and the figure indicates that such is the case.]

1882. *Pellicia perforata* Ploetz (Prittwitz ms.), Berlin Ent. Zeit., xxvi, p. 254. [Put under *ephora* H.-S. A nomen nudum.]

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[4] Dennison Univ. Bull. no. 21, p. 81, 1925.

Under *licisca* Ploetz.

1906. *Achlyodes melcheri* Weeks, Can. Ent., xxxviii, p. 176. [Suapure, Venezuela.]

1911. *Achlyodes melcheri* Weeks, Ill. Diur. Lep., ii, p. 27, pl. 19. [Lindsey,[5] Dennison puts this as a synonym of *licisca* Pl.]

Under *polyctor* [6] Prittwitz.

1870. *Helias ithrana* Butler, Trans. Ent. Soc. Lond., 1870, p. 519. [Peru, Rio Janeiro and Ega. Both Ploetz and Godman & Salvin sink this to *polyctor* Prit.]

Since the above was written Mr. Kenneth J. Hayward has published a paper on the Hesperids of Argentine,[7] in which he describes a number of new species of *Pellicia* and figures the male genitalia as well as those of two others as follows.

New species: ***hersilia***, p. 342, fig. 3; ***herse***, p. 433, fig. 4; ***hertha***, p. 433, fig. 5; ***hermione***, p. 434, fig. 6; ***hebe***, p. 434, fig. 7; ***alicoides***, p. 436, fig. 9.

Male genitalia figured: *gonoptila Burmeister*, p. 431, fig. 2; ***alicus*** Schaus, p. 436, fig. 8.

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[5] Dennison Univ. Bull., xxi, p. 81, 1925.

[6] Spelled *polyotor* on plate, emended in description.

[7] Ann. Soc. Cien. Argentina, vi, 1939.

STUDIES IN ORTHOPTERA WHICH OCCUR IN NORTH AMERICA NORTH OF THE MEXICAN BOUNDARY

PARTS X and XI

BY MORGAN HEBARD

(Plates VIII to X)

Reference is made to previous parts of this series which have already appeared,[1] and in which the general plan for the same is set forth. The chief purpose of the present contribution is to make available information accumulated largely in connection with extensive geographic studies which have been under way for some time.

The following descriptions, notes and figures were prepared by me during the winter of 1937–1938, but had not been given final attention or the plates prepared. It is now possible to publish this paper through the great kindness of my friends James A. G. Rehn and John W. H. Rehn, who have since done the necessary finishing work, as from that time I have been wholly incapacitated by very severe rheumatoid arthritis. I have been assured I will eventually be able to resume my work in a year or so.

X. NEW AND CRITICAL NOTES ON PREVIOUSLY-KNOWN TETTIGONIIDAE

PHANEROPTERINAE

BRACHYINSARA Rehn and Hebard[2]

It is of considerable interest to add this genus to those known from the United States, the addition of a second species requiring modification of the characters originally given to distinguish it from *Insara* F. Walker. The distinctive contour of the lateral margins of the pronotal disk holds only for the genotype of *Brachyinsara* and the organs of flight must be given as decidedly to greatly reduced.

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[1] All parts have appeared in these Transactions as follows: LIX, p. 363, I on *Psychomastax*, p. 371, II on *Cyphoderris*; LX, p. 31, III on the Decticinae, p. 281, IV on *Diapheromera*, p. 284, V on the Pachymorphinae; LXII, p. 231, VI on *Arethaea*; LXIII, p. 347, VII on *Timema* and supplementary information on *Diapheromera*, p. 354, VIII on new Acridinae, p. 361, IX on new and previously-known Oedipodinae.

[2] Trans. Amer. Ent. Soc., XL, p. 97.

Outstanding features shown by the present genus are the peculiarly irregular and sulcate fastigium which is in contact with the facial fastigium, the dilated abdomen with exposed tergites acute-angulate produced mesad at their caudal margins and very large male supra-anal plate (distal tergite).

Brachyinsara hemiptera new species (Plate VIII, figs. 1 and 2.)

This is the second known species of the genus, of which the genotype *magdalenae* Rehn and Hebard,[8] was described from Magdalena Island, Baja California. From that insect it differs in being definitely less robust, the pronotum with lateral margins of disk not divided into as strongly arcuate sections and so less conspicuously different from those of certain species of *Insara*, and the much greater production of tegmina and wings.

Type.—♂; Tia Juana, San Diego County, California. September 11, 1922. (M. Hebard.) [Hebard Collection, Type no. 1328.]

Size small, form moderately robust for the group, the abdomen very plump (but usually much shrivelled in dried material). Face with greatest width contained nearly one and four-fifths times in depth. Eyes globose, strongly exserted, much shorter than infra-ocular portion of genae. Pronotal disk with length considerably more than its greatest (caudal) width, longitudinally feebly concave so that it is slightly elevated cephalad and caudad; lateral margins moderately divergent in cephalic fourth, thence parallel in half remaining distance (occasionally slightly sinuous), then strongly divergent in caudal section; cephalic margin faintly concave, caudal margin very broadly convex (not as truncate as in *magdalenae*). Pronotal lateral lobes with length greater than depth, appreciably longer than in *magdalenae*, humeral sinus very shallow.

Organs of flight decidedly reduced but slightly surpassing end of abdomen (when that is full, as in life), portions beyond stridulating area of tegmina very narrow, wings slightly more produced than tegmina, the very narrow apices of these organs rather sharply rounded. Exposed abdominal tergites produced mesad on caudal margin in a stout spine, this merely suggested on penultimate tergite.

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[8] Trans. Amer. Entom. Soc., XL., p. 97, figs. 22 and 31, (1914).

Genitalia much as in *magdalenae*. Supra-anal plate very large, broad, its surface depressed and medio-longitudinally sulcate, the median portion of its distal margin transverse; thus two large lobes are formed with disto-lateral margins flattened convex, nearly enveloping the cerci. Cercus short, rather strongly curved inward with angulation indicated, tapering slightly to the flattened apex which terminates in a tooth directed meso-dorsad. Subgenital plate very short and broad, medio-longitudinally sulcate, free margins convex to minute nodes (the vestigial styles which are preceded by carinae on the ventral surface of the plate), between which the distal margin is truncate.

Cephalic and median femora slender, pinched and carinate dorso-distad and rectangulate produced at apex; genicular lobes produced in a broad (finely spined or blunt) tooth which (normally) bears a minute spine on its ventral margin; ventral margins lamellate distad, smooth (but occasionally bearing one or two minute teeth). Caudal femora moderately heavy for the group, with proximal portion enlarged; genicular lobes broad, strongly acute-angulate produced.

Allotype.— ♀ ; same data as type but taken by J. A. G. Rehn. [Hebard Collection.]

Very similar to male in ambisexual characters. Size slightly larger, caudal limbs noticeably more elongate. Organs of flight very slightly less reduced, projecting to (or slightly beyond) apex of ovipositor; marginal field not narrowing as strongly in median section.

Ovipositor small, considerably shorter than cephalic femur, deep, lamellate, sharply bent dorsad before median point, margins thence convergent then rounding to meet at apex, distad with dorsal margin extensively and ventral margin briefly evenly serrulate; lateral surfaces of valves thickly supplied distad with low nodules, these joining to form raised striae ventrad. Subgenital plate triangular with surface convex, the convergent lateral margins broadly convex to the narrowly blunted apex.

Coloration.— Generally dirty buff, light to moderately dark brown, or gray, but occasional specimens are tinged with light to slightly yellowish green and individuals of many series have flecks and dashes of darker brown, a few with sides and abdomen showing a reddish brown tinge. Antennae pale, in flecked individuals often having widely spaced brown flecks. Abdomen immaculate in pallid individuals, but in darker specimens dorso-laterad near base of exposed portion with a large dark brown suffusion invaded by a broad whitish marking and dorso-distad again darkened with a whitish line on each side. The specimens from Campo are exceptionally pale, light gray and immaculate.

Measurements.—Those of the type and allotype are followed by those of the smallest individuals in the series, from La Jolla Hills. Length of body, ♂, 15.7 to 10.7; ♀, 14.1 to 12.1: length of pronotum, ♂, 3.4 to 3.2; ♀, 3.4 to 2.8: caudal width of pronotum, ♂, 2.8 to 2.2; ♀, 2.7 to 2.1:

length of tegmen, ♂, 9.7 to 8.3; ♀, 11.7 to 10.3: median width of tegmen, ♂, 1.4 to 1.3; ♀, 1.7 to 1.2: length of caudal femur, ♂, 16.7 to 13.9; ♀, 19.2 to 16.6 mm. The majority of specimens in the present series approach the minimum measurements.

Specimens examined: 44; 22 males, 18 females and 4 immature individuals.

CALIFORNIA: La Jolla Hills, VIII, 20, 1931, (E. R. Tinkham), 4♂, 2♀, [Hebard Cln.]. Murray Canyon above Mission Valley, VIII, 19, 1937, (Rehn, Rehn & Pate; on hill slopes in chaparral, local, inactive and scarce), 1♂, 4♀, *paratypes*, [A.N.S.P.]. San Diego, VIII, 7, 1935, (R. H. Beamer), 1 medium small and 1 small juv. ♀, [Univ. of Kansas]; VIII, 10, 1916, (E. P. Van Duzee), 1 medium large juv. ♀, [Cal. Acad. Sci.]. Palm City, VIII, 7, 1933, (R. H. Beamer), 2♂, 2♀, [Univ. of Kansas and Hebard Cln.]. Port El Ysidro, VIII, 22, 1931, (E. R. Tinkham), 5♂, 3♀, *paratypes*, [Hebard Cln.]. Tia Juana, IX, 11, 1922, (Rehn & Hebard; beaten from brush, *Adenostoma fasciculatum*, near crest of hills at 200 feet, two hours further search failed to locate other specimens), 1♂, 1♀, *type* and *allotype*, [Hebard Cln.]. Campo, VIII, 23, 1931, (E. R. Tinkham), 5♂, [Hebard Cln.].

BAJA CALIFORNIA: Two miles south of Tijuana, VIII, 31, 1931, (E. R. Tinkham), 3♂, 6♀, [Hebard Cln.].

This inconspicuous but distinctive insect is evidently widespread through the dry chaparral of the hills and mountains in southwestern California and adjacent northwestern Baja California. With *Horesidotes cinereus saltator* Hebard and *Cycloptilum distinctum* Hebard the presence of a fauna very distinct from that of the Los Angeles region is plainly indicated. Another faunistic change is also soon met when going southward on the peninsula of Baja California.

Though often very difficult to locate, *hemiptera* is, for the Tettigoniidae, probably a fairly abundant species. The grasshopper *Horesidotes cinereus saltator* though undoubtedly more abundant and more readily located, is probably much more local in distribution. The cricket *Cycloptilum distinctum* may be also more abundant and as generally distributed as well, the fact that intensive search was not made for it (as we did not realize it was an undescribed species at the time) and that its very small size and secretive habits make it so easy to overlook probably accounts for so few specimens having been captured.

Like the species of *Insara*, the present insect is doubtless nocturnal and probably sings with a whirring stridulation not audible at any considerable distance.

Microcentrum louisianum new species

(Plate VIII, fig. 3; pl. X, figs. 23 and 26.)

The single male before me shows this species to be nearest *M. retinerve* (Burmeister), agreeing with males of that insect in general form, pronotal contour, tegminal venation, enlarged apices of the cerci and elongate styles of the subgenital plate.

It differs in having the vertex more dimpled than medio-longitudinally sulcate, the cephalic margin of the pronotum not evenly concave (this, however, possibly due to an individual distortion), the tegmina with stridulating field less ample and very differently and less conspicuously marked and stridulating vein less heavy and less elongate and the cercal apices definitely more strongly bilobate with the tooth smaller. For comparison with this species representative males of both *M. retinerve* (pl. X, figs. 24 and 27) and *M. rhombifolium* are here shown, pl. VIII, fig. 4; pl. X, figs. 25 and 28).

Compared with the Mexican species nearest resemblance is shown to the actually widely distinct *M. stylatum* Hebard.

Type.— ♂ ; Shreveport, Louisiana. August 19, 1915. (J. A. G. Rehn.) [Hebard Collection, Type no. 1331.]

Size small and form moderately robust for the genus. Head with lateral ocelli moderately large; vertex convex declivent, scarcely longer than broad, its surface dimpled and with medio-longitudinal sulcation barely indicated, its width at transverse sulcus (separating it from the frontal fastigium) appreciably more than twice that of a proximal antennal joint. Pronotum smooth, disk rounding sharply into lateral lobes and showing faint indication of broad transverse impression near cephalic margin and before metazona, the discal sulci weak but the principal sulcus prominent laterad on disk and dorsad on lateral lobes and cutting the lateral margins of the former; cephalic margin concave but showing a trace of broad and very feeble convexity mesad; lateral lobes deep, humeral sinus small but deep. Metasternal lobes with angles rounded rectangulate (broader than in *retinerve*).

Tegmina and wings fully developed, the former distinctly widest just beyond stridulating area, the sutural margin thence straight and gently oblique descendent to the rather broadly rounded apex; median vein sinuous with branches running to the sutural margin, veins at costal margin not thickened. Wings well surpassing tegmina.

Supra-anal plate vertical, strongly medio-longitudinally sulcate proximad, elongate triangular with lateral margins very weakly convex. Cerci elongate, cylindrical, slender, tapering slightly and incurved, with apex swollen and bilobate,[4] the inner lobe only moderately flattened (instead of strongly flattened as is the case in *retinerve*); the triangular chitinous tooth at disto-internal point on external lobe very small (proportionately smaller than in that species). Subgenital plate with weakly convergent rounded lateral carinae which are produced a distance equal to the width of each production, these productions each surmounted by socketed styles, each of which is nearly six times as long as broad, the intervening space narrowly U-emarginate, preceded by a medio-longitudinal carina.

Coloration.—General tone light green (kildare green in dried specimen). Eyes russet. Pronotal disk with minute microscopic dots of brown and under the microscope seen to be washed with lighter brown at the cephalic angles, mesad on the cephalic and caudal margins and at the shoulders, the sulci also tinged with brown. Tegmina with minute intervals between veinlets laterad and particularly caudad of the stridulating field embrowned, but with no trace of brown marking before and including the stridulating vein (which is apparently always shown by this sex of *retinerve*). Tibiae proximad, caudal femora meso-proximad and meso-distad tinged with brown and with microscopic darker flecks. In this insect all the dark markings are inconspicuous.

Length of body, 21.1; length of pronotum, 5.2; caudal width of pronotal disk, 3.7; length of tegmen, 34.8; greatest width of tegmen, 10.8; length of caudal femur, 18.8 mm.

The definite affinity shown to *retinerve* suggests that this is a species of the deciduous tree-tops, possibly distributed through the forests of the central and southern area west of the Mississippi. The type was taken in the undergrowth of a mixed deciduous and conifer forest.

PSEUDOPHYLLINAE

Lea floridensis divergens new subspecies (Plate X, fig. 29.)

1906. *Lea floridensis* Caudell, Jour. N. Y. Ent. Soc., XIV, p. 42, 2 text-figs. and pl. I, fig. 5. [♀, "Florida"; Pablo Beach, Florida.] (Description of genus and of female.)

1907. *Cyrtophyllus* (*Lea*) *floridensis* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1907, p. 302. [♂, ♀; Pablo Beach and St. Augustine, Florida.]

This race, known only from the northern portion of the east coast of Florida, and which has not been found any considerable distance inland, occurs from Pablo Beach south to La Grange. It is supplanted by the nominate race on the southern portion of the east coast from opposite Grant on the Indian River south to Coral Gables.

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[4] From study of other species of this and allied genera I believe that cercal differences have much more significance than is often the case with depth and degree of angulation of the emargination of the subgenital plate or with length of the styles.

It may be distinguished by its average smaller size, moderately constricted pronotum with lateral carinae definitely more divergent caudad and less broadly defined in color, and simple acute apices of the ventral arm of the male cercus.

Type.—♂; Pablo Beach, Florida. August 13, 1905. (Rehn and Hebard.) [Hebard Collection, Type no. 1336.]

Generally similar to *floridensis floridensis* (Beutenmuller) except as stated above. Appearance of pronotum definitely more constricted; the lateral margins of the disk defined by weak coarse carinae caudad only but outlined throughout in brown, slightly divergent caudad to principal sulcus, then slightly more divergent but weakly convex in curvature. Ventral arm of cercus terminating in a single acute tooth.

Allotype.—♀; St. Augustine, Florida. (C. W. Johnson.) [Academy of Natural Sciences of Philadelphia.]

No larger than the largest male, agrees with type except as follows. Tegmina narrower and without stridulating field. Ovipositor as in the nominate race; of moderate length, curved broadly dorsad to the acute apex, its ventral margin very finely serrulate distad, the lateral surface with two vertical short heavy ridges distad, of which the proximal is decidedly the heavier.

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Width of pronotum at principal sulcus	Caudal width of pronotum	Length of tegmen	Length of caudal femur
f. divergens						
Pablo Beach	30–40.	6.4–7.5	3.9–4.7	6.3–7.	32.–35.	23.1–24.2
La Grange	35.5	8	4.3	6.7	36.7	24.8
f. floridensis						
Indian River, *type* ..	35.	8.2	—	—	—	27.5
Coral Gables	38.–41.	8.5–9.	5.–5.7	6.4–6.8	34.7–35.	27.7–28.2
♀						
f. divergens						
St. Augustine	38.5	7.5	4.8	6.6	34.2	26.
La Grange	36.3	7.3	4.	5.8	35.3	24.
f. floridensis						
Juno	40.	8.4	5.2	6.3	38.8	26.8
Coral Gables	42.5–44.7	8.2–8.9	4.9–5.8	6.–6.6	32.6–34.7	27.9–28.8

The extremes in the series of ten male paratypes is given above. The ovipositor length of *floridensis divergens* ranges from 18.2 to 18.8 mm., and in *floridensis floridensis* from 18. to 18.8 mm.

Coloration.—Generally green; disk of pronotum with lateral margins defined in dark pinkish brown, this narrowly (and less conspicuously than in the nominate race) margined externally with buffy. The antennae are found to be annulate with brown distad or wholly immaculate in both races.

Specimens examined: 21; 19 males and 2 females.

FLORIDA: Pablo Beach, VIII, 13, 1905, (Rehn and Hebard; colony in bushes eight to ten feet high on land face of sand dunes back of beach), 11♂, *types* and *paratypes* [Hebard Cln., A.N.S.P., U.S.N.M.]. St. Augustine, (C. W. Johnson), 1♀, *allotype,* [A.N.S.P.]. Pomona, IX, 7, 1917, (Rehn and Hebard; moderately common on Cabbage Palmettos and in bushes in pine flatwoods at night, "fearlessly giving their peculiar wooden 'grrck' until approached within two or three feet"), 6♂, [Hebard Cln. and A.N.S.P.]. DeLeon Springs, IX, 8, 1917, (Rehn and Hebard; moderate numbers in high hammock, usually up fifteen to twenty feet but some only a few feet from the ground: "song regular, usually about thirty-eight per minute but when excited an individual increases the frequency up to nearly sixty a minute"), 1♂. La Grange, IX, 12, 1913, (W T. Davis; in oaks and Cabbage Palmettos but not in the pine woods), 1♀; I, 1914, 1♂, (both in Cabbage Palmettos; song accurately described by Davis as "chluck"), [both Davis Cln.[5]].

At De Leon Springs *Pterophylla camellifolia camellifolia* (Fabricius) was heard after dark in large numbers in the tops of the lofty oaks in the high hammock. We noticed that the song of *Lea* is decidedly weaker and of lower pitch.

In a letter from H. F. Strohecker I learn that he has heard this species at Ocala and Orlando where the present race is almost certainly the one represented.

Lea floridensis floridensis (Beutenmuller)

1903. *Cyrtophyllus floridensis* Beutenmuller, Bull. Amer. Mus. Nat. Hist., XIX, p. 637, 2 text-figs. [♂; Indian River opposite Grant, Florida.]

Recently at my request my colleagues Messrs. James A. G. Rehn and John W. H. Rehn made a comparison of the type of L. *floridensis,* in the American Museum of Natural History, with male material of both races of the species here recognized. The following comments have been taken from the notes made by them. The unique type ("Indian River, Florida", without further data) has been dried from alcohol and is in consequence somewhat shrivelled and the coloration destroyed. The wings are poorly spread, one antenna is lacking distad of the second article, while the right cephalic limb, the right caudal tarsus and most of the left one are also missing. The chief measurements of the type have been given in the preceding table. The type closely approximates a Coral Gables male with which it was compared, but in a few points it shows that it is from the southern border of the transitional area between the two races. The lateral rugosities (or carinae) of the pronotum are virtually as concave and as divergent as in typical *L. f. divergens*, the lateral lobes of the pronotum are less massive than in Coral Gables *L. f. floridensis* and somewhat near *L. f. divergens* in consequence, while the tegmina have the marginal field as broad and the ulnar vein as straight as in Coral Gables *L. f. floridensis*. The limbs are all proportionately longer than in the type of *L. f. divergens*, and as in the Coral Gables male compared. To sum up, in the bulk of its features the type of *L. floridensis* is distinctly nearer the southern form (i.e. that here termed *floridensis floridensis*) than it is to the more northern race (*L. f. divergens*) here described.

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[5] Recorded as *Lea floridensis* by Davis in 1914.

Davis in 1914 heard an individual of what was certainly the present race near Miami, stridulating every evening late in September in the Spanish Moss of a large oak in a clearing. This insect took immediate alarm at the approach of a light and so could not be captured.[6]

The undescribed female of the nominate race (Caudell's description of a female in 1906 was based on the female of *floridensis divergens* here described) may be separated from that sex of *divergens* by the ambisexual features of difference discussed here under that race.

I find that all females of the North American Pseudophyllinae have a tooth at the apex of the cercus. In *Paracyrtophyllus* and *Pterophylla* it is situated on the inner margin of the bluntly rounded cercal apex, but in *Lea* forms an apical fork with the more sharply rounded apex as has been described by Caudell.

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[6] Recorded as *Lea floridensis*. I also have noted that western species such as *Aglaothorax armiger* and *Capnobotes occidentalis*, proved to be very much more alert and wary at night when very few were to be heard stridulating, than when present in larger numbers and answering each others'calls.

Specimens examined: 12; 6 males and 6 females.

FLORIDA: St. Lucie, 1♀ (dried alcoholic), [U.S.N.M.]. Juno, IX, 5, 1936, (Rehn and Rehn; climbing Saw Palmetto leaf in dense coastal sand dune scrub), 1♀, [A.N.S.P.]. Miami, VIII, 9, 1937, (H. F. Strohecker), 1♀, [Hebard Cln.]. Coral Gables, VI, 14 to VIII, 2, 1937, (H. F. Strohecker), 5♂, 2♀ (one female light pinkish brown (apricot buff to sayal brown), others of the normal green color phase), [Hebard Cln.]. Homestead, XI, 1919 and 1920, (C. A. Mosier), 1♂, 1♀, [U.S N.M.].

COPIPHORINAE

BUCRATES Burmeister

1838. *Bucrates* Burmeister, Handb. Ent., II, abth. II, pt. 1, p. 708.

GENOTYPE (by monotypy as originally the only definitely included species), *Locusta capitata* DeGeer, 1773.

Described from an unknown locality, probably Brazil as suggested by Burmeister, material of the widespread tropical American genotypic species is before me showing a range from Panama to the River Amazon.

The genus is distinguished by the fastigium of the vertex being in strong contact with that of the frontal costa (particularly in the genotype with apex of the latter grooved to accommodate the apex of the former), and the slightly but distinctly lamellate dorsal margins of the caudal tibiae distad. The ovipositor is much as in many species of *Homorocoryphus* Karny and *Neoconocephalus* Karny, elongate, very feebly but appreciably decurved distad, slightly broadest meso-distad, the dorsal and ventral margins converging and showing feeble convexity to the acute apex.

From it *Parabucrates* Scudder is separated only by the shorter, moderately recurved ovipositor which tapers evenly distad to the acute apex (as characteristic of certain genera referred to the Agraeciinae).

The best sequence for the related American genera appears to be *Neoconocephalus, Homorocoryphus, Bucrates* and *Parabucrates*. The other American genera belong to distinct phyla, though *Caulopsis* may be considered an extreme development from the present in one direction and *Belocephalus* an extreme development from the same on a very different tangent.

A single species of this genus occurs in the United States.

Bucrates malivolans (Scudder)

1879. *Conocephalus malivolans* Scudder, Proc. Boston Soc. Nat. Hist., xx, p. 90. [♂; Cedar Keys, Florida.]

1905. *Conocephalus hoplomachus* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1905, pl. I, figs. 10 and 11. [♀; Chokoloskee, Florida.]

1914. *Homorocoryphus malivolans* Rehn and Hebard, Proc. Acad. Nat. Sci. Phila., 1914, p. 405. [♂; Detroit, Florida (and the above synonymy established).]

This insect was subsequently recorded from Tappahannock, Virginia, and Wilmington, North Carolina.

No differences of generic value from the genotype, *capitatus*, can be found, though *malivolans* is a decidedly more slender species, superficially rather suggesting *Neoconocephalus velox* Rehn and Hebard in general appearance. Prior assignment to *Homorocoryphus* was due to failure to note the slight but important generic difference in the lamellation of the dorsal margins of the caudal tibiae.

Both *capitatus* and *malivolans* are found to have the organs of flight either decidedly abbreviate or fully caudate, often at the same locality. Such dimorphism also occurs in *Parabucrates brevicauda* (Scudder), but not in any of the American species of *Neoconocephalus* or *Homorocoryphus*.

Though both brown and green color phases occur in this species, the latter is apparently much less often developed.

The immature stages show several features of decided phylogenetic importance. All have the fastigium of the vertex separated by a brief interval from that of the frontal costa, and the caudal tibiae do not show lamellation of their dorsal margins distad. Thus immatures of this species are indistinguishable from those of *Neoconocephalus* except by specific differences. Moreover the vertex is slenderly conical with sharply rounded apex in the very early stages, becoming progressively shorter and blunter to the adult condition.

Specimens examined: 74; 44 males, 14 females and 16 immature individuals.

VIRGINIA: Tappahannock, VI, 12, 1916, 3 medium large to medium small juv. ♂, 1 large juv. ♀ (2 males green, others brown); VII, 13 to VIII, 9, 1916, 11 ♂, 9 ♀ (3 brown males and 2 green females macropterous, others brown and brachypterous); VIII, 19, 1916, 6 very small juv. (brown); IX, 19, 1916, 2 small juv. (brown), (all H. Fox; in *Spartina cynosuroides*), [Hebard Cln. and A.N.S.P.].

GEORGIA: Eastern border of Okefenokee Swamp, VII, 30, 1934, (J. D. Beamer), 1 ♂ (green, brachypterous).

FLORIDA: Citrus Center, V, 2, 1912, (W. T. Davis), 1 ♂, (brown, brachypterous). Chokoloskee, V, 1903, *type* of synonymous *hoplomachus*, 1 ♀ (brown, brachypterous). Cocoanut Grove, III, 2, 1916, (M. Hebard; moderate numbers in reeds and bushes of salt marsh, only occasionally singing and then often only a single note), 1 ♂ (brachypterous), 1 medium juv. ♀ (both brown). Florida City (Detroit), VII, 12, 1912, (Rehn and Hebard; in saw grass in knee-high water on edge of Everglades), 1 ♂ (brown, brachypterous).

ARKANSAS: Hope, VII, 5, 1926, (L. Knobel; in light trap, only one of this species seen), 1 ♂.

LOUISIANA: Spanish Fort, VIII, 5 and 7, 1915, (Rehn and Hebard; in high grass of freshwater marsh, generally distributed and moderately abundant), 22 ♂, 2 ♀ (7 males and 2 females macropterous, others brachypterous, all brown), 1 medium juv. ♀ (brown), [Hebard Cln. and A.N.S.P.]. Orleans Canal near Spanish Fort, VIII, 5 and 7, 1915, (Rehn and Hebard; in high grass of fresh-water marsh), 3 ♂, 1 ♀ (macropterous, brown), 2 medium juv. ♀ (brown). Morgan City, VIII, 8, 1915, (Rehn and Hebard; small colony in group of bananas and in low grass at station), 1 ♀ (macropterous, brown), 1 small juv. ♂ (brown). Lafayette, VIII, 9, 1915, (Rehn and Hebard; in heavy broad-leaved swamp grass in "branch"), 1 medium large juv. ♀ (brown). Lake Charles, VIII, 10, 1915, (Rehn and Hebard; undergrowth and short grass in oak "hammock"), 3 medium to medium small juv. ♂ (brown).

There is considerable size variation, apparently having only slight geographic significance. Though the Virginia series averages smallest, the male from Florida City, Florida is smaller than the largest males from Tappahannock, Virginia. The female from Chokoloskee, Florida and the majority of the Louisiana specimens are the largest.

At Orleans Canal the song was noted as a "dzeeeee-dzeeeee-dzeeeee-dzeeeee", the notes being given eight times in five seconds, often preceded by a rustling sound audible at only a very short distance.

Present on or near the sea coast from central Virginia to western Louisiana, this insect inhabits salt and fresh-water marshes and swamps and in the low country invades adjacent woodlands. Lack of field work in its preferred environment accounts for the very wide gaps in its known distribution.

DECTICINAE

Idiostatus hendersoni[7] new species (Plate VIII, figures 5 and 7.)

This species, coming from the desert hills south of the Great Salt Lake in central Utah, is nearest *I. variegata* Caudell, (see plate VIII, figs. 6 and 8) described from a female from Pocatello, Idaho. Material of the genus is also before me from southwestern Idaho (one immature female, Gooding; one male, twenty miles south of Boise), northeastern Utah (two males and two females, Jensen) and extreme western central Utah (one female, Trout Creek). Though additional specimens can alone solve the problem as to how many species are represented, I can say definitely that those from Idaho are very near if not fully representative of *variegata.* The others are closely related but may represent distinct races or even species in each case.

To these species are related *I. magnificus* Hebard (Warner Mountains in northeastern California), to a less degree *I. elegans* Caudell ("Nevada") and to an even lesser degree *I. inermis* (Scudder) (just east of the Sierras from Oregon to central Nevada).

From my Idaho male, this sex of the present insect is easily distinguished by the shorter and heavier limbs, narrower median emargination of the penultimate tergite and the extremely elongate and very distinctive cercal spine. Though paler with less extensive markings, the extremes of coloration of the species in question are probably decided and so can not be determined for each without much more material.

Type.—♂; Leamington, Utah. July 19, 1918. (W. W. Henderson.) [Hebard Collection, Type no. 1334.]

Size medium large and form robust for the genus. Fastigium with width one and one-third times that of proximal antennal joint, showing merest trace of medio-longitudinal sulcation. Pronotum smooth, disk rounding evenly into lateral lobes except in the produced caudal portion where distinct though broadly rounded shoulders occur; caudal production brief with caudal margin truncate (in paratype mesad appreciably but very feebly concave mesad as in *variegatus,* this margin very feebly convex in

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[7] In honor of my friend, Dr. W. W. Henderson, the well known Utah entomologist, through whose kindness I have been enabled to study this remarkable new species.

magnificus); lateral lobes considerably longer than deep, much as in *magnificus* except that there is here the merest trace of a humeral sinus, convex callosity obsolete but bounding that area internally is a definite oblique impression.

Prosternum unarmed. Tegmina very greatly reduced, extending beyond pronotum about two-thirds pronotal length, largely exposed (to near proximal oblique portion of sinistral tegmen when at rest); median area mesocaudad in stridulating field rounded (rounded-quadrate in one paratype, similar but slightly longer than wide in the other).

Tenth tergite with a small broad meso-distal area of soft integument which has its inner margin convex. Penultimate tergite with a very broad meso-distal area of soft integument which is hirsute with distal margin bilobate, and having a small median emargination as deep as it is wide (the convex lateral sections decidedly less convex and the median emargination broader in *variegatus* and *magnificus*). Cercus stout, moderately elongate, shaft of subequal width and evenly moderately incurved; apex short and sharply conical, inner margin with a subapical conical but more swollen projection from which springs an exceedingly elongate spine which curves gently to its aciculate apex, is directed at slightly less than a right-angle to the shaft and is slightly longer than the distance from its base to the base of the shaft. Subgenital plate broad and ample, without a median carina but with sharply rounded lateral carinae which are weakly convergent (and straight to very faintly convex) to the small style sockets, between which the distal margin is emarginate at distinctly less than a right-angle, the sides of this emargination very feebly convex. Styles very small, simple, approximately three times as long as broad (slightly longer in a paratype), separated by a distance about one and one-third times the length of one of them.

Limbs rather short (shorter than in *variegatus*, longer than in *magnificus*). Genicular lobes with cephalic of cephalic (on one side with two spines in one paratype) and both of median with a minute short spine. Femoral margins armed with very minute spines (as follows: cephalic internal 0 to 5, cephalic external 0, median internal 1 to 4, median external 0, caudal internal 4 to 6, caudal external 1 to 8). Cephalic tibiae with dorsal surface armed on outer margin only with a proximal, median and distal spine.

Coloration.—Generally light buff (more or less discolored but not by alcoholic immersion). Occiput with a very fine line of dark brown which becomes broad caudad (reduced to a dot caudad in one paratype). Face, ventral margins of lateral lobes fairly broadly and caudal femora very light buff. Body otherwise immaculate except caudad; penultimate tergite with irregular proximal shining blackish brown margin which is broadest dorsolaterad. Cercal spine very dark brown. Femora almost immaculate, in one paratype with a dorso-proximal patch of inconspicuous brown dots and external surface with similar even weaker marking below median line mesad and a larger fleck of brown above that line distad (mere traces of but homologous to the markings shown in *variegatus*). Spines of limbs dark distad but on caudal femora entirely blackish brown surrounded at bases with small areas of the same color. Only in the type are the apices of the cephalic and median tibiae very light green.

(*Measurements* (*in millimeters*)

	Length of body	Length of pronotum	Caudal width of pronotum	Exposed length of tegmen	Length of caudal femur	Greatest width of caudal femur
Type	23.8	6.3	4.7	3.9	18.2	3.8
Paratype	23.2	6.7	4.7	4.4	18.4	3.9
Paratype	20.3	6.4	4.5	3.8	18.	3.8

Two male paratypes are before me, bearing the same data as the type.

METRIOPTERA Wesmael 1838

GENOTYPE: *Gryllus brachypterus* Linnaeus 1773, by monotypy.

An established synonym is *Platycleis* Fieber 1852, with genotype *Decticus intermedius* Serville 1839, fixed by Herman in 1874.[8] Splitting into other genera would appear to me to be less feasible than Uvarov has intimated, the large tessellate species (including *intermedia*), small tessellate species (including *tessellata*) and more solidly marked small species (including *brachyptera*) on examination being seen to agree much more closely than their appearance would suggest. On the other hand such aberrant species as *alticola* Tarbinsky and the Japanese *bonneti* and *japonica,* both described by Bolívar, may possibly require subgeneric or even generic separation. Their most striking differences are the ovipositor with dorsal margin faintly but definitely subserrulate in the first two of the above, but the ventral margin is serrulate in the first, smooth in the second and the pronotum has a faint but sometimes almost percurrent medio-longitudinal carina in the third.

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[8] See Uvarov, Trans. Ent. Soc. London. 1923, p. 528, (1924). Discussion of the genus is there given and explanation of Kirby's incorrect use of *Chelidoptera.*

The single North American species, *sphagnorum,* discussed below, belongs to the section which includes *brachyptera.* Of the species included there it is the most aberrant, but the eastern Asiatic *ussuriana* Uvarov, though distinctive, plainly represents a condition intermediate between it and *brachyptera.*

A very distinctive but related species, originally described as *Eremopedes brevicauda* by Caudell, must be generically separated, and the new genus including it and a new species is here described. These two species are confined to California.

The two genera in question may be separated as follows,—

Vertex normal but large, its width distinctly greater than the depth of the normal eye (in the genotype, but as large as in the alternate category in some of the species of *Metrioptera*). Pronotum with medio-longitudinal carina in metazonal portion only (but in *japonica* weak but often practically percurrent), (disk in genotype with weakly defined lateral carinae, these obsolete in some species, very decided in a very few species). Organs of flight fully developed to greatly reduced (fully developed to very decidedly reduced in genotype) but always with greater portion of stridulating field of male exposed beyond the proportionately definitely shorter pronotum. Limbs short to elongate, caudal femora scarcely over twice to over three times as long as pronotum. Caudal tibiae with disto-ventral pair of spurs larger than in *Decticita,* but differing in proportionate size in different species. Penultimate tergite of male not to very strongly produced above cerci (the latter condition shown only by the boreal American *sphagnorum*). Male subgenital plate normal. Female with sternites unspecialized (in genotype, *sphagnorum* and other species) or specialized (in many species). Ovipositor very short to moderately elongate (of medium length in genotype) and moderately thickened proximad and mesad, curved (usually evenly and not strongly) to the acute apex; dorsal margin smooth (in genotype and many species), armed distad in very few species; ventral margin never broad just beyond base, smooth or distad thickly irregularly subdenticulate (in genotype and *sphagnorum*) or there definitely, evenly serrulate (in only a few species). *Metrioptera* Wesmael

Vertex exceptionally large. its width distinctly greater than the depth of the large eye. Pronotum with medio-longitudinal carina percurrent (disk with weak to very decided lateral carinae). Organs of flight very greatly reduced, with narrow caudal margin of stridulating area of male alone exposed beyond the more elongate pronotum. Limbs short; caudal femora very robust proximad, slightly more than (male) to slightly less than (female) twice as long as the pronotum. Caudal tibiae with disto-ventral pair of spurs very small, inconspicuous. Penultimate tergite of male not produced above cerci. Male subgenital plate strongly emarginate distad, the lateral portions bearing the styles rotated into an almost vertical

(instead of the normal almost horizontal) plane. Female with sternites unspecialized. Ovipositor very short and very decidedly thickened proximad, deep proximad and mesad, curved dorsad to the acute apex, dorsal margin unarmed, ventral margin broad just beyond base and there finely transversely ridged, this surface becoming oblique distad.

***Decticita* new genus**

These genera share the following characters. Pronotal lateral lobes deep (normal for subfamily), not perpendicular, being slightly to definitely divergent ventrad. Prosternum unarmed. Ventral femoral margins unarmed. Cephalic coxae armed with a large slender spine. Cephalic tibiae with dorso-external margin armed with three spines and dorso-internal margin unarmed; auditory foramina rimate. Free plantula (beneath and at base of caudal metatarsus) moderately large, elongate ovate.

In *Metrioptera* the male cerci, though differing widely in different species, are in the great majority slender and armed with a single spine distad on the inner margin. In *ussuriana* Uvarov, however, they are short, armed proximad on the inner margin with a very elongate spine, and in *sphagnorum* they are large, straight, elongate conical, tapering to the rounded apex and armed proximad on the inner margin with a very small spine. Considering certain other genera of the North American Decticinae (*Ateloplus* and *Idiostatus*) two or even three distinctive cercal types are shown by unquestionably congeneric species, and such differences consequently do not have the phylogenetic significance which might be assumed.

The large number of alternate features given for *Metrioptera* are due to the very large size of that genus. Twenty-six Old World species in my collection and one additional in that of the Academy enable me to make a much more general study of that genus than has hitherto been published. Material of the genotype, *brachyptera,* both brachypterous and macropterous, is before me from France, Hungary and Siberia.

Metrioptera sphagnorum (F. Walker)

1869. *Decticus sphagnorum* F. Walker, Cat. Dermapt. Saltat. British Mus., II, p. 258. [♂, ♀; St. Martin's Falls, Hudson Bay.]

1909. *Idionotus brevipes* E. M. Walker, Canadian Entom., XLI, p. 143, pl. 7, figs. 3 and 3a. [♂; Fort William, Ontario (and notes on habits).]

Established synonyms are *Idionotus brevipes* based on a male from " Arctic America " and *Platycleis fletcheri* based on a female from Millarville, south of Calgary, Alberta, both of which Caudell described in 1907 and recognized as sexes of the same species the following year. The final synonymy was published by both E. M. Walker and Caudell in Blatchley in 1920.

Uvarov figured the genitalia of the male type in 1930, at which time he correctly stated that, though the male penultimate tergite is even more produced, closest affinity is plainly shown to *ussuriana,* a very similar appearing species which occurs in the Ussuri Region of far eastern Siberia, and of which I have four males and one female. The two are almost identical in coloration, *ussuriana* differing most decidedly in the male genitalia, but also in the much shorter ovipositor, much longer caudal limbs, strikingly more ample male stridulating area and longer female tegmina.

The present species has been recorded as *Idionotus brevipes* from Aweme, Manitoba, as common at Fort William, Ontario (when its soft trilling song was described and its habitat discussed), from Cold Lake, Alberta, and from Fort St. John and Rolla in the Peace River Block of British Columbia east of the Rocky Mountains.

The following material is in my collection unless otherwise noted.

MANITOBA: Marchand, VII, 9, 1936, (R. H. Handford), 4♂ [part Canadian Nat. Cln.]. Aweme, VIII, 17, 1908, (N. Criddle), 1♂.

ALBERTA: Cold Lake, IX, 6, 1930, (E. R. Tinkham), 1♀. MacLeod, VII, 26, 1926, (E. R. Buckell), 2♂.

BRITISH COLUMBIA: Fort St. John, VII, 29, 1927, (P. N. Vroom), 1♂ (compared with type by B. P. Uvarov). Rolla, VII, 2, 1927, (P. N. Vroom), 1♂.

The present insect occurs over a very extensive region, in most portions of which it is the only decticid known, reaching from Hudson Bay to the Rocky Mountains north at least to latitude 56°, and south to near the southern boundary of Canada. In the southern portions of its range it is undoubtedly limited to the more boggy boreal spots, and it is therefore probably both scarce and local in southern Manitoba, southern Saskatchewan and southeastern Alberta.

DECTICITA new genus

This genus is erected to include *Eremopedes brevicauda* Caudell and *balli* here described, of which the former is designated as genotype. Closely related to *Metrioptera* Wesmael, though in appearance differing very widely from any of the many species of that genus, the species of *Decticita* are known only from the Pacific drainage of central and southern California.

The fact that both of these species appear adult in June and have largely disappeared by early August partially explains the great scarcity of these insects in collections. They are apparently largely terrestrial, living in grasses both in dry and damp environment, but have most often been found in dry wild oats.

Outstanding features when compared with other North American Decticinae are the broad and bluntly rounded vertex, almost wholly concealed organs of flight in both sexes, almost vertical lateral produced portions of male subgenital plate and extremely short stout ovipositor, which is curved dorsad to its acute apex. The other diagnostic characters are here given in the comparison with *Metrioptera* under that genus on pages 176 and 177.

Decticita brevicauda (Caudell)

(Plate VIII, fig. 9; pl IX, figs. 21 and 22.)

1907. *Eremopedes brevicauda* Caudell, Proc. U. S. Nat. Mus., xxxii, p. 336, fig. 39. [♀; Napa County, California.]

The previously unknown male, as shown by one from Monte Diablo, California, differs from the female as follows:

Size decidedly smaller, form less robust. Pronotum slightly more produced caudad and showing some inflation (convexity of the dorsal surface) above the tegmina. The weakly defined lateral carinae are not truly parallel, being usually very feebly divergent cephalad in the brief cephalic section, then showing a trace of convexity throughout and so slightly widest meso-caudad; these features usually more prominent in the male.[9] Pronotal disk with lateral portions of crescent-shaped sulcus evident, this sulcus obsolete mesad (as is often the case in females). Tegmina reduced to stridulating area, all but the very narrow rounded apical area concealed by the pronotum. Penultimate tergite strongly transverse, lateral margins feebly oblique and very weakly concave to between the cerci with distal margin of this portion showing shallow concavity. Supra-anal plate vertical, small, shield-shaped. Cercus moderately elongate cylindrical but with internal surface strongly concave to near the apical tooth, about three times as long as median width, almost straight, widening very slightly proximad, thence of almost equal width to the bluntly rounded apex, with a very small short moderately recurved subapical spine surmounting a flattened triangular base on internal margin. Subgenital plate elongate, lateral portions almost vertical, median portion pinched into a decidedly fine medio-longitudinal carina which terminates at apex of the large subrectangulate distal emargination, disto-lateral portions almost vertical, elongate, with margins broadly convex to apex which is surmounted by a small straight simple style about three times as long as broad, these disto-lateral portions each with a heavy rounded medio-longitudinal carina.

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[9] In both sexes the median carina is coarse and percurrent, often low and not conspicuous (I do not feel that Caudell's statement "scarcely noticeable" describes this feature quite as satisfactorily).

Measurements (in millimeters)

♂	Length of body	Length of pronotum	Caudal width of pronotum	Ventral total width of pronotum	Length of caudal femur	Greatest width of caudal femur
Monte Diablo	13.3[10]	7.	2.7	4.2	13.4	3.
♀						
Napa County, *type*[11]	20.	6.5	—	—	18.5	—
Monte Diablo	16.8	7.1	3.	5.1	16.	3.3
Lindsay	19.	7.8	3.2	5.7	19.6	3.7

In the series before me the length of the ovipositor ranges from 6.9 to 7.9 mm. It is 6 mm. in length in the type. The species is probably subject to considerable size variation, my evidence indicating that more or less favorable conditions of immediate environment and amount and character of available food are important factors.

Coloration.—Ranging generally from ochraceous buff tinged with tawny to buckthorn brown. The broad lateral medio-longitudinal blackish streak on the caudal femora is always conspicuous but becomes diffused in the distal section of the enlarged portion and then disappears. The other features of coloration, here described under *balli*, are all similarly indicated in the present species, of which, however, I do not have any specimens showing anything like as much intensification.

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[10] In the male not including the produced subgenital plate.

[11] These measurements of the female type, in the American Museum of Natural History, were made for me by my colleagues Messrs. James A. G. Rehn and John W. H. Rehn.

Specimens examined: 18; 4 males, 11 females and 3 immature individuals.

CALIFORNIA: Lagunitas, V, 30, 1915, (J. W. Rich), 1 juv. ♀ in instar preceding maturity, [Hebard Cln.]. Sonoma County, III, 28, 1919, (T. B. Urbahns), 1 small juv. ♂, 1 medium juv. ♀, [U.S.N.M.]. Lindsay, San Joaquin County, V, 31, 1910, (J. R. Horton; in wild oats), 3♀, [U.S.N.M. and Hebard Cln.]. Clayton, VII, 20, 1935, (J. Beamer; in dry wild oats on hillside), 2♀, [Univ. of Kansas and Hebard Cln.]. Monte Diablo, VII, 21, 1935, (J. and R. H. Beamer; in dry wild oats about one mile from summit), 4♀, 5♀, [Univ. of Kansas and Hebard Cln.]. San Ramon, VI, 26, 1903, (in bird stomach), 1♀, [U.S.N.M.].

Decticita balli[12] new species (Plate VIII, fig. 10.)

This interesting insect supplants *D. brevicauda* (Caudell) throughout the southern portion of the range of the genus. It is known from the western slopes of the Sierra Nevada from the Yosemite to the Sequoia National Park west to the Coast from Santa Cruz to Oxnard.

It is easily distinguished in the male sex by the strikingly prominent pronotal carinae and the very much shorter, stouter, blunter cerci. Females differ, however, only in having the pronotal carinae slightly more prominent than in that sex of *brevicauda*. In the early stages the pronotal carina are often very weakly indicated.

Type.—♂; San Luis Obispo, California. June 14, 1934. (E. D. Ball.) [Hebard Collection, Type no. 1335.]

Generic characters given above. Agrees closely with this sex of *brevicauda* as here discussed under that species except as follows. Pronotum with medio-longitudinal and lateral carinae of disk[13] very coarse, rounded and very prominent; the latter weakly convergent briefly toward cephalic margin, thence weakly divergent caudad but becoming feebly convex mesocaudad so that they are again weakly convergent (or parallel) in brief portion near caudal margin; the intervening spaces of the disk thus narrow and in transverse section strongly concave. Cercus short, stout, cylindrical but with internal surface strongly concave to near the apical tooth, from above appearing less than twice as long as wide but from below seen to be slightly more than twice as long as the median width, shaft weakly but definitely curved inward, scarcely narrowing to the very bluntly rounded apex with a very small short and moderately recurved subapical spine surmounting a flattened triangular base on internal margin. The cerci are apparently usually directed dorso-mesad, instead of horizontal and parallel as is the case in *brevicauda.*

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[12] Named in honor of Dr. E. D. Ball of the University of Arizona, who collected the type, and has aided me greatly in my studies by securing many little known Southwestern species of Orthoptera during the past eight years.

[13] Only in the southern Russian *Metrioptera medvedevi* Miram, of the species of that genus before me, do the lateral carinae of the pronotal disk show similar decided development, suggesting those of the present species but much less pronounced.

Allotype.— ♀ ; same data as type. [Hebard Collection.] Very similar to this sex of *brevicauda* except that the pronotal carinae are more prominent, sometimes as well defined as in the males of that species but much weaker than in the males of the present insect.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest (meso-caudal) width of pronotum	Ventral total width of pronotum	Length of caudal femur	Greatest width of caudal femur
Huckleberry Meadows	13.2[14]	5.7	2.	3.9	11.	2.3
Monterey	15.4[14]	6.7	2.3	4.1	15.7	2.9
Lockwood	15.3	7.8	3.	4.8	14.8	3.2
San Luis Obispo, *type*	13.7[15]	7.8	2.6	3.9	15.7	2.8
♀						
Huckleberry Meadows	16.7	6.1	2.7	5.	14.	2.9
Monterey	16.8[15]	6.4	2.8	4.9	18.3	3.4
Lockwood	20.	7.7	3.2	5.8	19.6	3.8
San Luis Obispo, *allotype* ..	16.8	7.2	3.	5.3	18.	3.7

In the series the ovipositor length ranges from 6.8 to 7 mm. Size is apparently greatly influenced by conditions of local environment.

Coloration.— Agrees throughout with *brevicauda.* Different series show wide differences in recession and intensification, the general coloration ranging from ochraceous buff tinged with ochraceous tawny to mars brown. The ventral and caudal margins of the pronotal lateral lobes are broadly buffy, inconspicuous in pale individuals but striking in dark specimens. The abdomen dorsad and laterad is darker, separated by moderately broad dorso-lateral paler longitudinal bands. The caudal femora have a broad blackish medio-longitudinal external band which becomes diffused and disappears at the end of the enlarged portion. Two specimens show a dark brown fleck before the pale margin of the pronotal lateral lobes opposite the shallow humeral sinus.

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[14] Abdomen extruded.

[15] Abdomen retracted.

Specimens examined: 32; 14 males, 10 females and 8 immatures.

CALIFORNIA: Yosemite Valley, 3880 to 4000 feet, VI, 7, 1928, (E. O. Essig), 1 juv. ♀ in last instar, [Hebard Cln.]. Huckleberry Meadows, Giant Forest, IX, 5, 1932, (P. H. Timberlake; on *Senecio clarkianus*), 2♂, 2♀, [Univ. Cal. Coll. Agr. and Hebard Cln.]. Giant Forest, 6000 feet, VII, 21 to 26, 1907, (J. C. Bradley), 1 medium small juv. ♂, [Cornell Univ.]. Coalinga, VI, 1 to 3, 1907, (J. C. Bradley), 1♀, [Hebard Cln.]. Santa Cruz, VI, 6, 1922, (E. O. Essig; in tall grass of damp meadow), 1♂, 1♀, 5 juv. ♂, 1 juv ♀, [U.S.N.M. and Hebard Cln.]. Langley Canyon, Gavilan Range, near Prunedale, 250 feet, VIII, 10, 1937, (Rehn, Rehn and Pate; pair seen in tall yellow grass near ground, quite active), 1♀, [A.N.S.P.]. Monterey, VII, 22, 1935, (J. and R. H Beamer; in wild oats with much poison oak and frequent oak trees), 1♀, 2♀, [Univ. of Kansas and Hebard Cln.]. Lockwood, VII, 24, 1935, (Beamer and Russell; in wild oats and one singing at night in wild buckwheat, *Eriogonum* sp.), 2♂, 1♀, [Univ. of Kansas and Hebard Cln]. San Luis Obispo, VI, 14, 1934, (E. D. Ball), 5♀, 1♀, *type, allotype* and *paratypes,* [Hebard Cln.]; VI, 26, 1935, (C. C. Wilson; beaten from grasses), 1♂, 1♀, *paratypes,* [U.S.N.M.]. La Panza, V, 27, 1935, (C. C. Wilson), 1♀, [U.S.N.M.]. Oxnard, V, 12, 1914, (J. E. Graf), 1♀, [Hebard Cln.].

XI. NEW GENERA AND SPECIES OF AND CRITICAL NOTES ON PREVIOUSLY-KNOWN GRYLLACRIDIDAE

SALISHELLA new genus

This genus is erected to include the single species, *mirabilis* here described. In general appearance it agrees closely with *Pristoceuthophilus* Rehn, but may be readily distinguished by the very different, more ceuthophiloid, vertex; the extraordinary specialization of the male abdomen, and the remarkable development of the first two tarsal joints, in this latter feature agreeing only with the otherwise very different Central American *Phoberopus* Saussure & Pictet.

Presence of a small pre-median spine on the dorso-internal margin of the cephalic tibiae in one of the two specimens before me (the paratype) is a very surprising feature. Comparable armament, a post-median but otherwise homologous spine, in the also widely distinct *Udeopsylla* Scudder alone of the North

American Rhaphidophorinae, affords in that genus a constant diagnostic character.

The following characters are diagnostic. Fastigium a low convex projection, with a very fine medio-longitudinal sulcus in its dorsal portion. Maxillary palpi with soft (sometimes only apical) sensory area of last joint prolonged as a ventral cleft nearly to base. Thoracic nota all with cingulate ventro-lateral margins. Apterous. Male with dorsal surface of abdomen and genitalia, excepting cerci, very highly specialized. Male subgenital plate entire, not divided into lateral halves, apex emarginate, styles present. Limbs of moderate length for the group, the caudal femora moderately stout. Median femora with internal genicular lobes bearing a small spine. Ventral margins of caudal femora (weakly) armed. Caudal tibiae with dorsal margins armed with minute teeth and with (seven) pairs of well spaced (less than three times their own length), large, socketed spines; distad with three pairs of spurs of which the median is over twice as long as the ventral. Caudal metatarsus unarmed dorso-distad. Pulvilli of first two tarsal joints broad throughout, their surfaces deeply concave in dried specimens. Male cerci simple, moderately stout proximad.

Salishella mirabilis new species (Plate IX, figure 11.)

Very similar in appearance to species of *Pristoceuthophilus*, but widely distinct as noted above.

The amazing specialization of the male abdomen is carried far beyond that of any other known North American species except *Pristoceuthophilus gagei* Hubbell, the outstanding feature being transverse dorsal flanges instead of large blunt spiniform projections.

Type.— ♂ ; Pierce, Idaho. Elevation 3200 feet. May 23, 1929. (W. E. Shull.) [Hebard Collection, Type no. 1330.]

Size and form medium; limbs medium but caudal femora rather more slender than in the species of *Pristoceuthophilus*. Eyes not strongly protruding. Antennal sockets very briefly separated. Antennae very elongate, much longer than body (from paratype). Face full, clypeus moderately convex. Palpi very elongate, the last joint feebly curved and slightly over twice as long as the preceding joint (from paratype). Nota and median segment smooth and moderately glabrous. First to seventh abdominal tergites inclusive laterad very sparsely and finely tuberculate, each with entire dorsal portion traversed by an even prominent transverse median and caudal lamellate ridge, the intervals between these evenly and strongly concave. Eighth tergite narrowly but slightly more widely projecting than seventh, with surface smooth and caudal margin broadly convex except for a large broadly transverse median impressed and less strongly sclerotized area bounded cephalad by a delicate carina. Epiproct highly specialized as two very large lobiform plates, lateral and nearly horizontal in position, each with dorsal surface convex but coming to a bluntly rounded apex dorso-laterad, their inner margins concave and connected by an extensive soft integument which permits them to swing strongly laterad. Beneath these are the rather small simple cerci, moderately stout proximad, weakly sigmoid, tapering to acute apices which project as far caudad as do the styles. Paraprocts also large, produced vertically with caudal surfaces flattened and dorsal apices rounded; these not visible when the two parts of the epiproct are closed (in normal position). Penis with entire ventral portion sclerotized, fitting the surface of the subgenital plate snugly and with lateral margins similarly convergent to the less strongly sclerotized broadly truncate apex, its surface sinistro-distad with a patch of minute microscopic spines, which are even finer than those which thickly cover the adjacent caudal surface of the large fleshy penis. To this plate latero-proximad is hinged the sclerotized pseudosternite, its lateral margins briefly moderately convergent, then less strongly so to its rather broadly convex apex, its ventral surface concave and its form such that when not elevated its feebly cingulate deflexed margins fit the sides of the sclerotized ventral plate of the penis so that these hard portions completely surround that soft organ. Subgenital plate large, surface convex; lateral margins convergent, weakly convex then weakly concave, to the cerci, between which the plate is sub-rectangulate emarginate (rounded obtuse-angulate emarginate in paratype). Styles very small, simple, socketed, approximately twice as long as broad. Ventral margins of cephalic and median femora unarmed, of caudal femora supplied with minute teeth, dorsal and external surfaces of caudal femora smooth. Caudal tibiae straight, with five to no minute teeth between the socketed spines of the dorsal margins; spurs not elongate, the median much the longer, the meso-internal slightly the longest, about half as long as the metatarsus; dorsal surface distad with three external and two (or three) internal small spines. Metatarsus and second joint of all limbs with ventral surface completely occupied by a comparatively wide pulvillus (transversely deeply concave in these dried specimens), these joints terminating dorso-distad in a subchitinous blunt projection. Tarsal claws short, about two-fifths as long as last tarsal-joint; arolia absent.

Coloration.—Chestnut brown, flecked with pale ochraceous tawny or buffy, these flecks fusing so that occiput and most of the meso-cephalic portion of the pronotum is pale and also forming irregular longitudinal lines on the abdomen. Limbs pale ochraceous tawny or buffy, the caudal femora and to with a less degree the caudal tibiae marbled with chestnut brown.

Measurements.—Those of the type are followed by those of a male paratype, from the Olympic Mountains, Washington, in the author's collection. Length of body, 11. and 10.2; length of pronotum, 3.4 and 3.2; total width of pronotum, 3.2 and 3.2; length of cephalic femur, 5.2 and 4.9; length of caudal femur, 10.7 and 9.8; width of caudal femur, 2.7 and 2.4; length of caudal tibia, 10.8 and 10.3 mm.

Ceuthophilus hubbelli[16] new species (Plate IX, figures 18 to 20.)

This insect is very closely related to *C. mescalero*[17] Hubbell but may be distinguished as follows. Male with apex of ninth tergite broader and less thickened; with convexity of its lateral margins around the cercal bases distinctly broader and not as deep, but much of this difference may be due to distortion in the type of *mescalero.* Pseudosternite of similar type but with cephalic lobe considerably less produced and broader, evenly and generally more heavily sclerotized without oblique ridges or proximal medio-longitudinal thickening and auriculae separated by a broader concave interval. The dorsal apices of the male subgenital plate appear to be decidedly broader and more produced dorsad (compare Hubbell, plate XXIII, fig. 678), but examination of the type of *mescalero* shows that distortion in drying is mainly if not wholly responsible for this. The male cerci are more elongate, not as decidedly thickened proximad and taper more gradually to their very slenderly acute apices. Females are so similar that series without males might prove to be indistinguishable, but in *hubbelli* the cerci show the same difference as do those of the male though to a much less degree and the ovipositor averages proportionately slightly shorter.

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[16] It is a pleasure to name this interesting new species in honor of my friend, Dr. T. H. Hubbell, whose monograph of the genus *Ceuthophilus* is an outstanding landmark in the progress being made toward an intelligent and scientific knowledge of the Orthoptera of North America.

[17] Described from near summit of White Mountain Peak, New Mexico, at 11,000 feet. I am astonished that so closely related species should be found in two such widely separated and different faunistic areas. The type and allotype of *mescalero* are in the author's collection; distortion from drying after immersion in a liquid preservative makes accurate illustration of certain important parts difficult.

The species next in affinity would appear to be *C. mormonius* Hubbell, which differs particularly in the male pseudosternite having the cephalic lobe much more produced and the auriculae very much smaller and very widely separated.

These species I feel should be placed in a group by themselves "The Mormonius Group", preceding the Hualapai Group, in the following order; *hubbelli* here described, *mescalero* Hubbell and *mormonius* Hubbell.

Type.—♂; Twin Falls, Idaho. Elevation 3700 feet. August 25, 1937. (R. E. Miller.) [Hebard Collection, Type no. 1329.]

Size medium small; form moderately attenuate; surface subglabrous, abdominal tergites sparsely setose; limbs elongate. Fastigium very low and rounded, dorsal groove fine but distinct. Antennae very elongate. Eyes subovate, slightly over one and one-quarter times as deep as wide. Ultimate palpal joint very elongate, arcuate. Pronotum slightly broader than long in dorsal aspect. Apterous. Abdomen very feebly widened distad. Ninth tergite weakly produced in median section with angles rounded and distal margin there broadly rounded obtuse-angulate emarginate mesad. Epiproct vertical, simple, its surface impressed, vertically feebly sulcate mesad and laterad, distal margin very broadly convex. Cercus rather short, proximal portion thick, thence tapering gracefully to the very slender apex. Pseudosternite with cephalic lobe delicate, large, curled proximad, its margin evenly rounded, its height about three-fifths its proximal width; ventral margin of arch weakly bracket-shaped; lateral auriculae very large; produced above cephalic lobe, their ventro-caudal surface shagreenous, the concave area between them not as large as one of them. Subgenital plate cleft throughout, dorsal apices well produced and rounded, attingent. Cephalic and median femora slender, the former faintly the stouter; ventral margins armed as follows, of cephalic-internal one to four minute spines, cephalic-external unarmed, median-cephalic two to four, median-caudal none to three. Caudal femora elongate and slender but slightly shorter and less slender than in *mescalero*. Caudal tibiae straight, considerably longer than caudal femora. Caudal metatarsus very elongate, pulvillus extending almost to base where there are a few setae. Claws moderately elongate, half as long as last tarsal joint.

Allotype.—♀; same data as type. [Hebard Collection.]

Similar to male but slightly larger. Distal abdominal tergites simple, lacking the very minute acute median projection found on the eighth and ninth in this sex of *mescalero*. Ovipositor very long and slender but slightly less so than in this sex of that species, distal portion extremely fine; inner valves fall short of apices of distal valves by about one-fifth ovipositor length; ventral valves armed with five slender simple short well-spaced teeth, the first three barely retrorse, almost vertical. Subgenital plate simple and very small, transverse, its distal margin broadly convex.

Coloration.—Very pale ochraceous-tawny; pronotum, mesonotum, metanotum and proximal abdominal tergites slightly darker toward their caudal margins, giving a very feebly transversely striped appearance. Eyes dark brown. Pronotum showing an almost obsolete pattern, which is possibly slightly more pronounced in life. Ovipositor darker, clear ochraceous-tawny becoming tawny distad.

Measurements.—The measurements of the type and allotype are followed by those of the smallest male paratype and the female paratype. Length of body, ♂, 13 to 14.3; ♀, 10.8 and 15.3: approximate total pronotal width, ♂, 3.1 to 3.7; ♀, 3.7 and 3.7: length of caudal femur, ♂, 10.8, 11.3; ♀, 11.8 and 10.9: greatest width of caudal femur, ♂, 2.7, 2.7; ♀, 3 and 2.9: length of ovipositor, 9.1 and 9. mm.

In addition to the type and allotype, two male and one female paratypes and one large immature male, bearing the same data, have been studied.

From structure and coloration it appears probable that this insect is an inhabitant of the bare dry foothills in southeastern Idaho.

Ceuthophilus gertschi Hubbell (Plate IX, figures 12-17.)

1935. *Ceuthophilus* nearest *arizonensis* Hebard, Proc Acad. Nat. Sci. Phila., LXXXVII, p. 76. [♂; Rancho del Monte at 7000 feet and Tesuque at 6800 feet, Santa Fé County, New Mexico]

1936. *Ceuthophilus gertschi* Hubbell, Univ. Fla. Publ. Biol. Sci. Ser., II, no 1, pp. 250 and 551, 6 figures. [♂; Bluff, Utah (type) and specimens not specifically assigned by Hebard]

Since recording the specimens which I collected there has been uncertainty as to their correct status. Recently, through the kindness of the University of Michigan, I have been enabled to examine the unique male type of *gertschi* and I refer my specimens to that species without hesitation.

Unfortunately the type is dried after immersion in a liquid preservative with the result that the delicate and remarkable production of the ninth abdominal tergite appears more decidedly and completely sclerotized than was probably normal, and in addition it has its lateral portions greatly warped and curled inward.

From my material, in a perfect state of preservation, the diagnosis of *gertschi* should be emended as follows. Abdomen not widened distad; eighth tergite rounded obtuse-angulate produced; ninth tergite with a produced median lobe which is very feebly sclerotized, this lobe very large and about one-fifth longer than its basal width, showing faint carination mediolongitudinally proximad, faintly to distinctly tectate (this difference probably produced in drying), its lateral margins broadly convex (and in drying slightly to distinctly curled downward) to the rounded apex, the dorsal surface thickly supplied with setae except in apical portion. Pseudosternite with auriculae rounded triangular, their external margins broadly convex, their internal margins broadly concave, a ridge on their caudal faces running from their apices to the arch where these ridges are produced as small triangles.

I here figure the distorted ninth tergite of the type and that process as well as the pseudosternite in my male from Tesuque. In color my specimens are pale ochraceous-tawny, the proximal portions of the pronotum, mesonotum, metanotum and all of the abdominal dorsum darker, the pronotum showing in addition a vague and restricted darker pattern. Thus they appear moderately transversely barred, but otherwise scarcely maculate.

As stated by Hubbell, this species is a highly aberrant member of the Arizonensis Group.

EXPLANATION OF FIGURES

PLATE VIII

Fig. 1.—*Brachyinsara hemiptera* new species. Male. *Type.* Tia Juana, San Diego County, California. Dorsal view. (× 2½.)

Fig. 2.—*Brachyinsara hemiptera* new species. Female. *Allotype.* Tia Juana, San Diego County, California. Lateral view. (× 2½.)

Fig. 3.—*Microcentrum louisianum* new species. Male. *Type.* Shreveport, Louisiana. Ventral aspect of apex of cercus. (Greatly enlarged.)

Fig. 4.—*Microcentrum rhombifolium* (Saussure). Male. Bowie County, Texas. Ventral aspect of apex of cercus. (Greatly enlarged.)

Fig. 5.—*Idiostatus hendersoni* new species. Male. *Type.* Leamington, Utah. Dorsal view of tenth tergite. (Greatly enlarged.)

Fig. 6.—*Idiostatus variegatus* Caudell. Male. Twenty miles south of Boise, Idaho. Dorsal view of tenth tergite. (Greatly enlarged.)

Fig. 7.—*Idiostatus hendersoni* new species. Male. *Type*. Leamington, Utah. Cercus from dorsum. (Greatly enlarged.)

Fig. 8.—*Idiostatus variegatus* Caudell. Male. Twenty miles south of Boise, Idaho. Cercus from dorsum. (Greatly enlarged.)

Fig. 9.—*Decticita brevicauda* (Caudell). Male. Monte Diablo, California. Cercus. (Greatly enlarged.)

Fig. 10.—*Decticita balli* new species. Male. *Type*. San Luis Obispo, California. Cercus. (Greatly enlarged.)

PLATE IX

Fig. 11.—*Salishella mirabilis* new genus and species. Male. *Paratype*. Olympic Mountains, Washington. Dorsal surface of abdomen. (Greatly enlarged.)

Fig. 12.—*Ceuthophilus gertschi* Hubbell. Male. *Type*. Bluff, Utah. Dorsal view of ninth tergite. (Greatly enlarged.)

Fig. 13.—*Ceuthophilus gertschi* Hubbell. Male. *Type*. Bluff, Utah. Lateral view of ninth tergite. (Greatly enlarged.)

Fig. 14.—*Ceuthophilus gertschi* Hubbell. Male. Rancho del Monte, two miles east of Tesuque, New Mexico. Dorsal view of ninth tergite. (Greatly enlarged.)

Fig. 15.—*Ceuthophilus gertschi* Hubbell. Male. Rancho del Monte, two miles east of Tesuque, New Mexico. Lateral view of ninth tergite. (Greatly enlarged.)

Fig. 16.—*Ceuthophilus gertschi* Hubbell. Male. Tesuque, New Mexico. Pseudosternite from dorsum. (Greatly enlarged.)

Fig. 17.—*Ceuthophilus gertschi* Hubbell. Male. Tesuque, New Mexico. Dorso-caudal outline of subgenital plate. (Greatly enlarged.)

Fig. 18.—*Ceuthophilus hubbelli* new species. Male. *Type*. Twin Falls, Idaho. Pseudosternite from dorsum. (Greatly enlarged.)

Fig. 19.—*Ceuthophilus hubbelli* new species. Male. *Type*. Twin Falls, Idaho. Pseudosternite in lateral aspect. (Greatly enlarged.)

Fig. 20.—*Ceuthophilus hubbelli* new species. Male. *Type*. Twin Falls, Idaho. Dorsal view. (× 2½.)

Fig. 21.—*Decticita brevicauda* (Caudell). Male. Monte Diablo, California. Dorsal view. (× 2.)

Fig. 22.—*Decticita brevicauda* (Caudell). Female. Clayton, California. Lateral view. (× 2.)

PLATE X

Fig. 23.—*Microcentrum louisianum* new species. Male. *Type*. Shreveport, Louisiana. Dorsal view. (× 1⅛.)

Fig. 24.—*Microcentrum retinerve* (Burmeister). Male. Plummer's Island, Maryland. Dorsal view. (Natural size.)

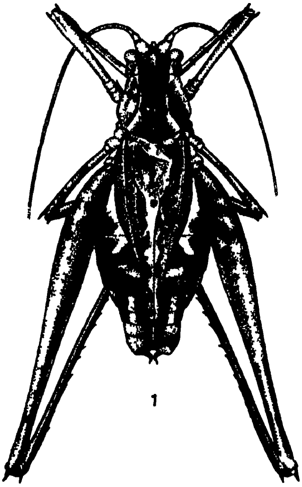
Fig. 25.—*Microcentrum rhombifolium* (Saussure). Male. Bowie County, Texas. Dorsal view. (Natural size.)

Fig. 26.—*Microcentrum louisianum* new species. Male. *Type*. Shreveport, Louisiana. Lateral view. (× 1⅛.)

Fig. 27.—*Microcentrum retinerve* (Burmeister). Male. Plummer's Island, Maryland. Lateral view. (Natural size.)

Fig. 28.—*Microcentrum rhombifolium* (Saussure). Male. Bowie County, Texas. Lateral view. (Natural size.)

Fig. 29.—*Lea floridensis divergens* new subspecies. Male. *Type*. Pablo Beach, Florida. Dorsal view. (Seven-eighths natural size.)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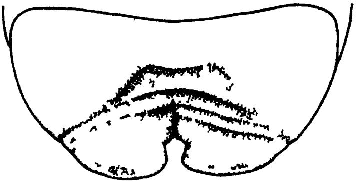
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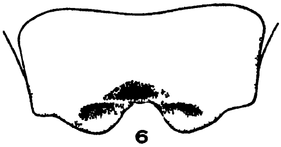
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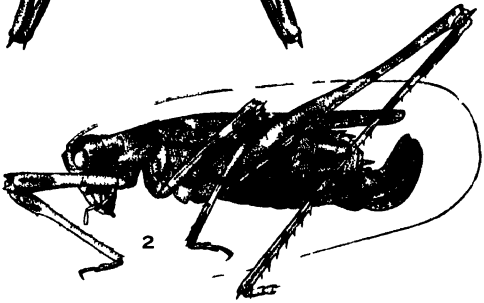
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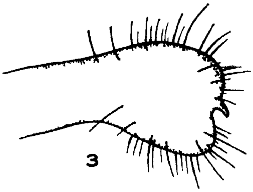
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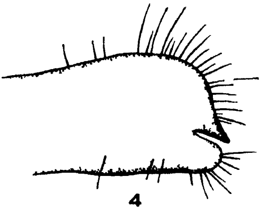
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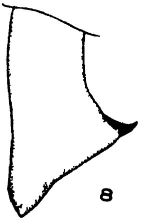
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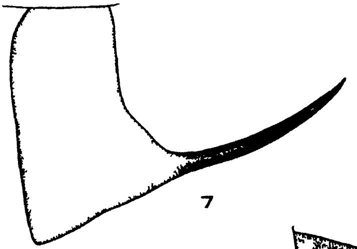
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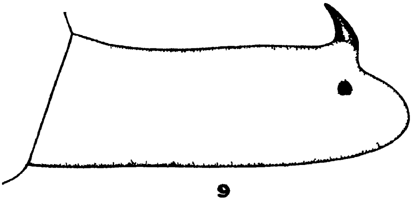
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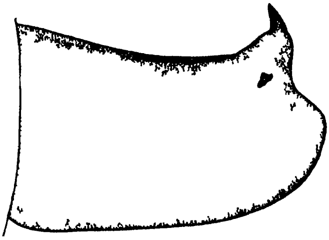
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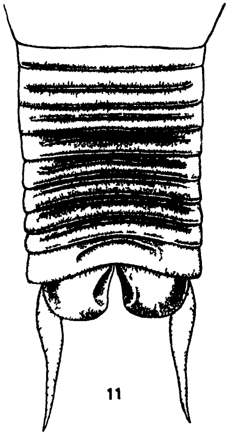
HEBARD—NORTH AMERICAN ORTHOPTERA



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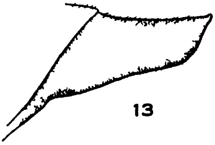

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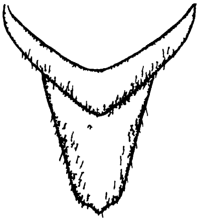

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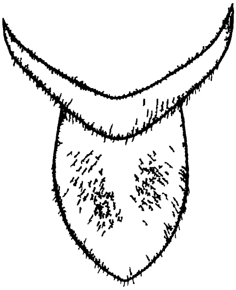

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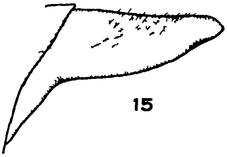

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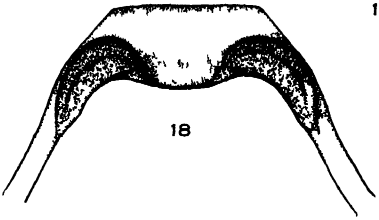

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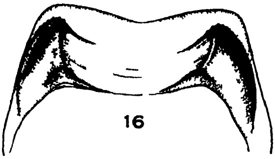

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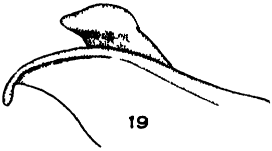

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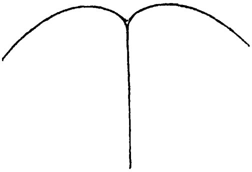

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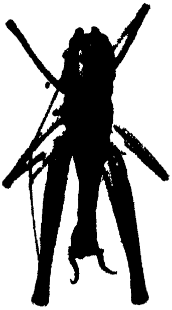

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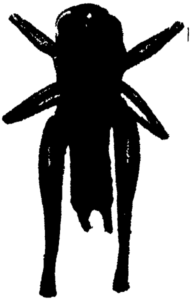

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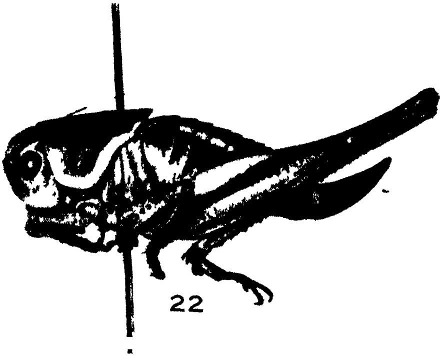

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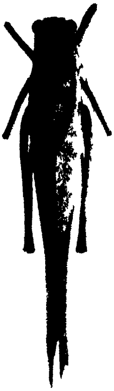
HEBARD—NORTH AMERICAN ORTHOPTERA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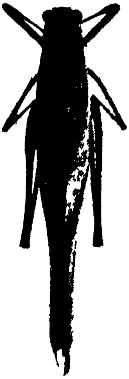

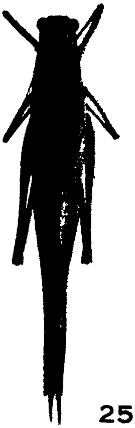
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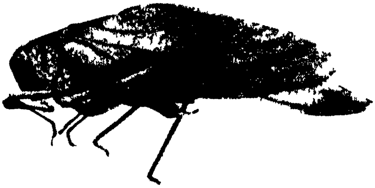
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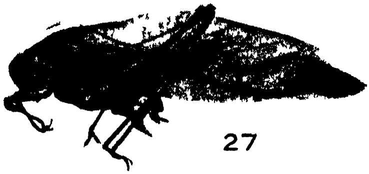
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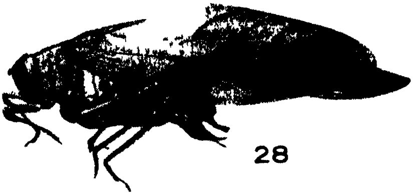
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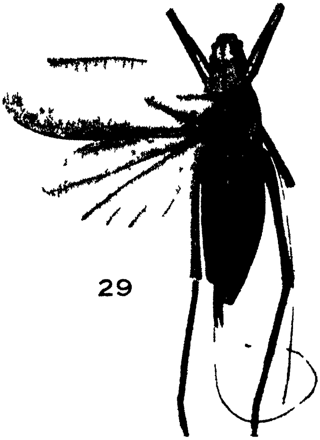
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HEBARD—NORTH AMERICAN ORTHOPTERA

A NEW GENUS AND FOUR NEW SPECIES OF ACRIDIDAE FROM BRAZIL AND ARGENTINA

(ORTHOPTERA)

BY JAMES A. G. REHN
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(Plates XI and XII)

The new forms here described have been encountered in the course of recent studies occasioned in the work of determining material for various correspondents. The types are all in the collection of the Academy, or in the Hebard Collection there deposited.

ACRIDINAE

LAPLATACRIS[1] new genus

A near relation of the Neotropical genus *Paratruxalis* Rehn,[2] from the genotype of which, *P. filatus* (Walker), the new genus differs chiefly in the shorter and more incrassately ensiform antennae; in the continuously marked and uniformly parallel lateral carinae of the pronotal disk, these being weakly diverging on the metazona in *Paratruxalis,* in which they may also off-set at the principal sulcus, which latter is the only one severing these carinae in *Laplatacris,* while in *Paratruxalis* they are also cut by a more cephalic transverse sulcus; in the narrow tegmina with more strongly etched venational relief; in the narrow tegminal apical margin being roundly oblique with the immediate apex very decidedly rounded subacute, instead of broader and sharply and definitely oblique truncate with the immediate apex sharply acute; in the interspace between the metasternal lobes (in the female) being definitely longitudinal instead of cuneiformly quadrate; in the female ultimate sternite (subgenital plate) having the distal margin as a whole acute-produced, instead of as a whole transversely biconcavo-truncate with a slender acute median process between the ventral ovipositor valves, as in *Paratruxalis*.

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[1] From La Plata, and ἀκρίς, *locust.*

[2] Trans. Amer. Entom. Soc., XLII, p. 276, (1916).

Generic features.—Alate. Form subcompressed. Head with face markedly retreating: fastigium, as seen from dorsum, with median length and greatest breadth subequal (♂) or slightly broader than long (♀), in outline subacute semi-elliptical, surface broadly subimpressed within margins, leaving a restricted disk bearing a medio-longitudinal carinula reaching cephalad to apex of fastigium; fastigio-facial angle rounded acute in profile; frontal costa marginally carinulate, moderately sulcate; lateral facial carinae supplemented in part by closely placed accessory ones; antennae stout, subdepressed, moderately ensiform. Pronotum with disk subdeplanate; lateral and median carinae parallel, continuous except for the single severance of the principal sulcus; lateral lobes subvertical. Tegmina slightly (♀) or distinctly (♂) surpassing apex of abdomen, narrow, lanceolate, slightly tapering distad; apex rounded subacute, venation strongly longitudinal in disposition; anal field with areolations minute, irregular and anastomosing. Wings with fenestrations of ulnar area of male conspicuous, occupying at broadest point faintly more than half of breadth of anterior field, fenestrae quadrate to rectangulate; apex of wing similar in shape to the tegminal apex in the same sex. Interspace between mesosternal lobes subrectangulately longitudinal (♂) to quadrate (♀); metasternal lobes attingent in the male, interspace definite and evenly longitudinal in the female. Ultimate sternite (subgenital plate) of male rostrately produced, but not compressed or carinate ventrad; ultimate sternite (subgenital plate) of female with its whole distal margin acute-angulate produced. Caudal tibiae with internal calcaria virtually subequal in length.

GENOTYPE: *L. dispar* new species.

Laplatacris dispar new species

(Pl. XI, figs. 1, 2, 3, 4 and 5; pl. XII, fig. 12.)

TYPE.—♀; Buenos Aires, Argentina. (C. Lizer.) [Academy of Natural Sciences of Philadelphia, Type no. 5595.]

Size relatively small; surface weakly rugulose on the lateral lobes of the pronotum and on pleura.

Head with its dorsal length slightly less than dorsal length of pronotum, dorsal line not at all ascending cephalad as seen in profile; least dorsal interspace between eyes to greatest fastigial width as 2.5 to 3.2; fastigial margins, as seen from dorsum, arcuate-convergent but much more strongly so in cephalic two-fifths, the apex well rounded and in no way angulate;

surface of fastigium with a broad and subequally wide but shallow subimpressed juxta-marginal girdle, reaching from the inter-ocular area but divided cephalad by the distinct but delicate medio-longitudinal carinula, which is obscurely continuous over the whole dorsum of the head:[3] in profile the fastigio-facial angle is rostrately pronounced but well rounded, the slant of the face not starting dorsad of the axis of the antennal insertions; facial line nearly straight oblique; frontal costa definitely narrowed at fastigio-facial angle, subequal in width thence to the median ocellus and slightly and regularly widening ventrad of the same, sulcation distinct but not deep, becoming obsolete near clypeal suture and represented by biseriate puncta on the fastigio-facial rostrum; lateral facial carinae distinct, evenly concave divergent, supplementary carinae mesad of and paralleling lateral ones more or less continuously from the antennal scrobes ventrad to near the clypeal suture: eyes not at all prominent, greatest width across same but slightly more than twice fastigial width; in lateral aspect the outline of the eye is subacutely produced dorso-cephalad, its greatest width contained one and two-thirds times in its greatest length. Antennae equal to one and one-third times dorsal length of head, robust, definitely but crassately ensiform, greatest breadth equal to four-fifths that of inter-ocular space, seventeen to eighteen articles, those from nine distad less depressed, cribrosely punctulate with sensory pits, apex blunt acute.

Pronotum with greatest width of disk faintly less than half greatest length of same (as 5.2 to 11); lateral carinae parallel, definitely continuous except for severance by the principal transverse sulcus, which is slightly caudad of middle, no other sulcus indicated on disk, median carina distinct and continuous except for the single severance, more finely carinulate than lateral ones; cephalic margin of disk subtruncate, caudal margin very weakly obtuse-angulate: lateral lobes of pronotum subvertical, subrectangulate, the greatest dorsal length (along lateral carina) nearly one and one-half times the greatest depth (as 10 to 7); cephalic margin straight oblique, obscurely undulate, ventral margin in cephalic half concavely emarginate, in caudal half straight, caudal margin obscurely erosulate subconcave, surfaces of metazonal section with longitudinal, subparallel, coarsely etched micro-nodulose striatulae, which are correlated with the erosulae of the caudal margin.

Tegmina with apices surpassing those of the caudal femora by a distance equal to one-third dorsal length of head, as a whole narrow, the greatest width of tegmen (at basal lobule of costal field) contained five and four-fifth times in the greatest tegminal length; costal margin with proximal lobulation weak, straight thence to the distal eighth, which is weakly arcuate to the narrowly rounded apex, the distal margin suturad of which is briefly oblique-arcuate to the quite straight sutural margin: principal and intercalated elements of the venation strongly longitudinal in disposition; marginal field with mediastine vein distinct and continuous, costal and postmediastine less extensive ones regularly spaced; median vein beginning its even and gradual divergence from the other elements of the humeral trunk as far proximad as the proximal third of the tegmen, intercalated vein present but broken and not continuous; between the two ulnar veins is placed a marked and continuous intercalary nervure, cross nervures of the distal half of the discoidal field numerous, forming generally rectangulate areolets, in proximal half the areolation is closer and more irregular; anal field as a whole densely and irregularly areolate, the axillary vein and a more extensive adventitious subsutural longitudinal nervure well marked. Wings with greatest breadth subequal to half the length, hyaline, distal fourth of anterior field with its shape that of the same portion of the tegmen; margin of axillary lobe of the radiate field definitely arcuate; first radiate vein heavier than the others; anterior field with ulnar area but slightly widened and with longitudinally rectangulate areolets, not at all suggesting the condition found in the male sex.

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[3] This is obsolete caudad of the ocular interspace in one female paratype (Buenos Aires), and little evident in a male allotype, but apparent in the other individuals of the species which I have examined.

Abdomen definitely compressed, dorsum quite decidedly medio-longitudinally carinate; ultimate tergite (supra-anal plate) acute trigonal, compressed, in general tectate with a medio-longitudinal sulcus flanked by parallel, substrumose cariniform ridges; ovipositor valves subcompressed, in profile tips are seen to be definitely falcate; dorsal surface of dorsal valves deeply carved disto-mesad, external margin more lamellate than internal; ventral valves with proximal plate transversely sinuato-truncate distad; ultimate sternite (subgenital plate) with its distal margin as a whole acute-produced, the lateral converging margins subsinuate, and the immediate apex more aciculate.

Cephalic and median limbs relatively short. Caudal femora in length but little more than half that of the tegmina, relatively slender, greatest depth contained about four and one-half times in the femoral length; lateral pagina deeply and regularly etched, genicular extremity. not definitely enlarged; caudal tibiae nine-tenths as long as the femora, external margin with nine to ten spines, internal with eleven; external spurs shorter than internal ones, the latter virtually subequal in length, definitely falcate in distal half; caudal tarsi with proximal article somewhat longer (as 7 to 5) than distal one.

Allotype.—♂; Buenos Aires, Argentina. [Hebard Collection.]

Differing from the above description of the female in the following noteworthy features.

Size distinctly smaller, about a third less in all dimensions: form more compressed.

Head in profile with dorsal line very slightly ascending cephalad; fastigium as seen from dorsum faintly narrower, with the cephalic apex very weakly angulate, the subimpressed juxta-marginal girdle enclosing laterad a narrow median discal area, on which the medio-longitudinal carinula is slightly more evident than in the female: in profile the fastigio-facial angle is slightly more acute and less narrowly rounded than in the female, the obliquity of the face is straighter and more decided: frontal costa and facial carinae as in female but former with sulcation reaching fully over the fastigio-facial rostrum, while the lateral facial carinae are more indirect and undulate: eyes somewhat more prominent than in female, greatest width of head across same nearly two and one-half times that of fastigium, in lateral aspect greatest width of eye is contained one and one-half times in greatest depth of same. Antennae in form as in female, but of slightly greater length, equal to one and five-sevenths times dorsal length of head.

Pronotum as in female, but with lateral lobes slightly less longitudinal, and more decidedly etched into longitudinal micro-nodulose striatulae and intervening groovings.

Tegmina very briefly surpassing the apices of the caudal femora, in outline as in female except that they are faintly broader, the greatest width (at basal lobule of costal field) being contained five and three-fourth times in the greatest tegminal length, while the apex is as a whole slightly more rounded. Wings as a whole similar to those of female but apex more rounded and the peripheral margin of the axillary field is slightly less arcuate; ulnar area markedly widened, at broadest point equal to distinctly more than half the width of the anterior field, divided into approximately nine subquadrate or subrectangulate fenestrae by transverse to oblique-transverse cross-nervures.

Ultimate tergite (supra-anal plate) scutellate, trigonal, weakly tectate, apex rounded rectangulate, converging margins sinuate at distal third: surface with a median excavate fossa in proximal two-fifths, thence distad without sulcation or carinations. Cerci simple, styliform, tapering, apex blunt acute, in length reaching virtually to apex of ultimate tergite. Ultimate sternite (subgenital plate) produced, conical, immediate apex subacute, in lateral view the dorso-lateral margins are straight, except for a short proximal arcuation.

Limbs as in female except that the cephalic and median femora are appreciably more robust.

Coloration.—Brown phase (seen in all individuals examined except a female paratype) in general tone ranging from buckthorn brown and dresden brown to wood brown, the latter often frosted with dull creamy white: occiput with narrow and definite or subobsolete subarcuate, caudad diverging occipital lines of prout's brown to mummy brown, postocular bars of the same color may or may not be present, when indicated sharply defined dorsad and becoming evanescent ventrad; lateral carinae of pronotum pencilled with ochraceous-buff; face with or without fuscous streaking of the infra-ocular sulcus and similar cloudings ventrad on or about the frontal costa, genae with a few fuscous punctae; eyes of the general color, with or without a sublongitudinal line of fuscous; antennae of the general color, occasionally darkening distad; lateral lobes of the pronotum generally pale in ventral fourth, and usually obscurely lineate with darker; tegmina with obscure series of longitudinally disposed subquadrate punctae in the discoidal field and less definitely in the anal field, in one specimen (♀ paratype), there is a definite humeral pale creamy white stripe in proximal half of tegmina; wings hyaline, veins pencilled in brownish; caudal limbs as a whole of the general color, femora occasionally lined with paler ventrad on external pagina; caudal tibiae with spines pale, black tipped.

Green phase (present in a single female paratype) largely olive-ocher, more definitely olive-yellow on proximal half of marginal field of tegmina and of caudal femora; dorsum of head, pronotum and remainder of tegmina, as well as abdomen and ventral surface of thorax, ochraceous-tawny; postocular dark bars finely marked, greenish fuscous; pale pencilling of lateral carinae of pronotum as in brown phase; lateral lobes of pronotum solidly of the general color; brownish punctae of tegmina as in brown phase; ventral surface of caudal femora and caudal tibiae ochraceous-tawny, obscurely mottled with darker brown, genicular arches of femora washed with fuscous; tibial spines pale, tipped with black; eyes buckthorn brown.

Measurements (in millimeters)

	Length of body	Length of pronotum	Greatest width of dorsum of pronotum	Length of tegmen	Length of caudal femur
♂, Buenos Aires, *allotype*	14.8	2.7	1.4	11.4	8.6
♂, Buenos Aires, *paratype*	15.3	2.9	1.4	11.4	8.9
♀, Buenos Aires, *type*	21.5	4	1.9	16.1	11.4
♀, Buenos Aires, *paratype*	19.7	3.7	1.9	14.6	11.4
♀, Estac. José C. Paz, *paratype*	21.5	3.7	1.9	15.6	11

In addition to the type and allotype I have before me a paratypic male and female bearing the same data as the allotype, and a paratypic female from Estación José C. Paz, Argentina, taken September, 1932 by Dr. José Liebermann, sent by the Argentine Locust Institute, and now in the collection of the Academy. The José C. Paz female is in the wood brown extreme of the brown phase, with much paler lining, the Buenos Aires female paratype is the sole green phase individual we have seen.

This striking form has remained unreported in the Academy collection for a number of years, and was again brought to my attention by the specimen sent by Dr Liebermann. Years ago I had recognized its nondescript character and so labelled it, but I had not then made the full comparisons here presented. The species, so Dr. Liebermann writes, is very common and injurious in natural pastures in the Province of Buenos Aires.

Amblytropidia sola new species (Pl. XI, figs. 6 and 7.)

A very striking member of the genus, in general appearance not closely related to any of the previously known and now recognized forms of *Amblytropidia,* all of which are now before me, many represented by the types or paratypes.[4]

Probably the nearest relative is *A. chapadensis* Rehn,[5] of which topotypic Chapada material is before me, the general form of the pronotum and the relatively robust caudal femora being more nearly as in that species, although the fastigium is narrower and more exserted as seen from the dorsum, suggesting that of *A. vittata* Giglio-Tos.[6] However, no previously known species has the tegmina of the relatively short and subinflated type seen in *sola,* these falling appreciably short of the apex of the abdomen, and with a very broad (proportionately) anal field, while the very marked greenish yellow lateral line which reaches from below the eye across the ventral section of the lateral lobes of the pronotum and the pleura to the caudal coxal fossa is found in no other species.

Type.—♂; Nova Teutonia (Correio Ita), State of Santa Catharina, Brazil. October 14, 1935. (Fritz Plaumann; H. 60.) [Academy of Natural Sciences of Philadelphia, Type no. 5598.]

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[4] It so happens that not only has the excellent series of the Philadelphia collections of the genus, containing eighteen species, been examined, but a representation of authentic Bruner determined material of the genus, containing two additional species, loaned by the Carnegie Museum, has also been available. The two lots give a representation of every form of *Amblytropidia* now recognized as valid, as well as types of certain forms which have been formally synonymized.

[5] Proc. U.S. Nat. Mus., xxx, p. 371, (1906). [♂, ♀; Chapadà, Matto Grosso, Brazil (type locality); Sapucay, Paraguay.]

[6] Boll. Mus. Zool. Anat. Comp. Univ. Torino, IX, no. 184, p. 13, (1894). [♀; Luque, Paraguay.]

Size medium; form subcompressed; surface of disk and lateral lobes of the pronotum, pleura and face and, in part, much less distinctly the genae, rugulose.

Head with dorsal line of the same slightly shorter than greatest length of pronotum, very faintly arcuate and briefly rounding to the not at all sharp fastigio-facial angle; occiput and interocular area with usual paired arcuate, caudad diverging, carinuliform rugulae, and a distinct but no more prominent median carina, which, however, cephalad on the fastigium becomes more decided in emphasis: fastigium, as seen from dorsum, faintly longer than its greatest width, from which point its carinulate lateral margins but moderately converge cephalad to the broad and bluntly rounded apex, surface of fastigium rugulose, with lateral margins and median carina etched into distinct relief; least width of interocular space equal to five-sixths the greatest fastigial width: facial line markedly and even retreating, very faintly arcuate; frontal costa broad, slightly wider between antennal bases than at median ocellus, but slightly narrowed dorsad at passing into fastigio-facial angle, lateral margins subcarinate, surface between subcribrosely rugulose; lateral facial carinae moderately diverging to slightly ventrad of eyes, thence to clypeal suture more strongly so. Eyes ovate in outline as seen in lateral aspect, greatest breadth in same view equal to two-thirds of greatest length, but moderately prominent as seen from dorsum. Antennae of type usual for genus, subequal in length to one and one-fifth times the dorsal length of head and pronotum combined, composed of twenty-four articles.

Pronotum with dorsum slightly longer than dorsum of head, subdeplanate, with carinulate lateral margins, greatest width of dorsum equal to three-fifths length of same, slightly and evenly widening caudad; cephalic margin of disk angulato-truncate, caudal margin of disk low obtuse-angulate; median carina marked, more decided than that of head, cut by principal transverse sulcus slightly caudad of middle: lateral lobes of pronotum subquadrate, the depth faintly less than dorsal length; cephalic margin moderately straight oblique, ventral margin weakly sinuate, caudal margin subsinuate, ventro-caudal angle rounded obtuse-angulate; metazonal portion with surface more finely cribroso-punctate than prozonal section.

Tegmina slightly exceeding apex of abdomen and falling short of apices of caudal femora by a distance subequal to half of the pronotal length, in shape rather broad lanceolate, the greatest width of the whole tegmen contained four times in the length of the same, the middle half of tegmen subequal in width, the distal fourth narrowing with apex bluntly rounded: costal margin with basal lobe little pronounced, low rounded, but slightly differentiated from the more distal portion of the same margin; sutural margin largely straight before the distal fourth: marginal field at broadest point equal in width to three-eighths that of maximum of tegmen, and subequal to the width of anal field at same distance, i.e. one-fourth of length, from tegminal base: mediastine vein marked and continuous to distal fourth of tegmen, where it joins the costal margin, accessory veinlets, one exterior to the mediastine, the other between the mediastine and the humeral trunk, reach to middle of tegmen; humeral trunk with its elements separating distad from slightly proximad of middle of tegmen; no intercalated vein present, anterior ulnar vein joining the very straight and marked posterior ulnar vein at two-thirds of tegminal length; anal vein parallel to and even more marked than the posterior ulnar vein; axillary vein marked, subsinuate, in general parallel to the anal vein, reaching to briefly distad of fusing of ulnar veins; areolation of most of discoidal and anal areas irregular, in distal fourth more definitely larger, regular and rectangulate, with intercalated nervures. Wings when in repose reaching to tegminal apices, with greatest breadth equal to half greatest length, apex narrowly rounded; anterior field relatively narrow, areolation simple, rectangulate.

Interspace between mesosternal lobes subquadrate, faintly broader than long; metasternal lobes subcontiguous caudad of foveolae. Abdomen dorsad faintly carinate medio-longitudinally: ultimate tergite (supra-anal plate) trigonal, proximal width and median length subequal, lateral margins subarcuately convergent to the narrowly rounded apex; surface of ultimate tergite (supra-anal plate) medio-longitudinally rather deeply and broadly sulcate, margining carinae evenly converging distad, proximal half with supplementary carinae close to and largely paralleling the proximal half of the lateral margins to which they are joined at their distal extremities, surface of tergite between median and lateral carinae subexcavate: cerci styliform, tapering, large, their subacuminate apices well surpassing the apex of the ultimate sternite: ultimate sternite (subgenital plate) bluntly rostrate acuminate, apex definite but well rounded in dorsal and lateral aspects, the preapical section of the lateral faces of the sternite pinched in dorsad so that the dorsal margins are less ample than the swell of the sternite ventrad of these margins and the subnodose apex is thus appreciably delimited.

Caudal femora robust (for genus), greatest depth contained four and one-half times in greatest length of same; caudal tibiae with eleven to twelve external spines, twelve internal ones.

Coloration.—Dorsal surface of pronotum and entire tegmina russet, becoming mummy brown on disk of dorsum of head, there bordered lateral by ochraceous-buff clouding; dorsal three-fourths of genae and the lateral lobes of pronotum and dorsal half of pleura greenish fuscous, clearer fuscous on the lateral lobes; face, mouthparts and an area encircling the median coxae and joining that of the opposite side by cephalad encompassing the cephalic half of the sternum, olive-citrine; a pair of striking yellow bars extend from the ventro-cephalic border of the eyes below same, across the lower genae, the ventral fourth of the lateral lobes and ventral portion of the pleura to dorsad of the caudal coxae. Eyes tawny-olive; antennae cinnamon-brown, darkening distad. Tegmina with proximal half of marginal field darkening to mars brown; wings very weakly infumate, veins pencilled with prout's brown. Sterna pale dull citrine; abdomen dull cinnamon-rufous distad, nearer clear yellowish proximad; cerci bister. Cephalic and median limbs olive-ocher, washed with and as a whole passing distad to dresden brown; caudal femora cinnamon-rufous, paling along ventro-external carina to clear yellowish, distal extremity blackish fuscous; caudal tibiae vinaceous-rufous, briefly blackish fuscous proximad, distad briefly obscured, spines tipped with black, caudal tarsi hazel.

Measurements.—Length of body, 17.1 mm.; length of pronotum, 3.5; greatest (caudal) width of disk of pronotum, 2.2; length of tegmen, 11.5; greatest width of tegmen, 2.9; length of caudal femur, 11.4.

The type of this striking species is unique.

Sinipta acuta new species (Pl. XI, fig. 8; pl. XII, fig. 10.)

Nearly related to the genotypic species *S. dalmani* Stål,[7] of which a number of individuals of both sexes from Argentine localities are before me. The type of *dalmani* came from Montevideo, Uruguay; but while no topotypic material is in hand the original description shows clearly the Argentine form is true *dalmani* or something exceedingly close to it, while *acuta* is quite different. The new species can at once be distinguished, in the female, the only sex available, from *dalmani* by the more compressed form, the more acutely produced head, the more narrowly acute fastigium, as seen from the dorsum and in profile, the more elongate eyes, which also are even less evident from the dorsum than in *dalmani*, the narrower and less ventrad widening frontal costa, the longer and more definitely ensiform antennae, the much less rounded and almost rectangulate caudal margin of the pronotal disk, the narrower longitudinal pale strumose line on the lateral lobes of the pronotum and metapleura, and the more distinctly acute-produced genicular lobes of the caudal femora. The male sex, when known, will doubtless show equally marked differences.

I have figured, for comparison with the same views of the type of *acuta*, a female of *Sinipta dalmani* Stål, from Carcaraña, Argentina, taken by Lawrence Bruner, and in the collection of the Academy (see plate XI, figures 9 and plate XII, fig. 11).

Type.—♀; Rio Grande do Sul, Brazil. [Hebard Collection, Type no. 1344.]

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[7] Kongl. Svenska Fregatt. Eugenie's Resa, II, Zool., I, Insecta, p. 340, (1861). [♀; Montevideo, [Uruguay].]

Size medium (essentially as in *S. dalmani*); form markedly compressed, definitely more so than in *dalmani*, body depth as in latter; surface texture and sculpture in general as in *dalmani*.

Head definitely pyramidical as seen in both dorsal and lateral aspects, as seen from dorsum with greatest (caudal) width of entire head to dorsal length of same as 4 to 4.2, as against 4 to 4.7 in *dalmani*, in profile dorsal line of head is nearly straight, hardly at all ascendant: fastigium in dorsal aspect acute trigonal, nearly equilateral (greatest breadth to length caudad to least interocular space as 1.8 to 1.4, as against 1.7 to 1.2 in *dalmani*), converging lateral borders of the fastigium nearly straight, cephalic apex rather narrowly rounded; least interocular space proportionately more sharply and less concavely narrowed than in *dalmani*, to greatest fastigial with as 1.4 to 1.8, as against 1.4 to 1.7 in *dalmani*; surface of fastigium more narrowly and less definitely channelled within lateral margins than in *dalmani*, median carinula of head finely indicated, on fastigium faintly less definite than in *dalmani*: in profile fastigio-facial angle rounded acute, facial line markedly retreating, straight-oblique; foveolar areas laterad on fastigium linearly impressed: frontal costa narrow, dorsad at its fastigio-facial extremity hardly wider than one-half width of proximal antennal article, as against subequally wide in *dalmani*, the width of costa ventrad evenly increasing except for a nearly subequal portion between antennal bases and median ocellus, lateral margins of costa definitely carinate to near ventral fourth, where they are less marked and definitely not as divergent as in *dalmani*, sulcation of costa definite in all but ventral third, reaching dorsad to the narrowed extremity, instead of obsolete in the interantennal region as in *S. dalmani*. Eyes as seen from dorsum less evident, straighter in outline and shorter than in *dalmani*, in lateral view the eye-form is seen to be more attenuate, quite definitely narrower (length to breadth as 2.8 to 1.5 as against 2.6 to 1.6 in *dalmani*), cephalic portion relatively attenuate. Antennae elongate, equal to one and one-half times the length of the pronotal dorsum, instead of one and two-fifths times the same as in *dalmani*, distinctly deplanate, more strongly ensiform than in *S. dalmani*.

Pronotum with disk relatively narrow, cephalic margin of same moderately arcuate, more so than in *S. dalmani*; caudal margin of disk definitely obtuse-angulate, more distinctly angulate than in *dalmani*, immediate angle narrowly rounded; median carina marked, somewhat more incrassate than in *dalmani*, lateral carinae also more incrassate than in *dalmani*, lateral carinae also more incrassate, supplementary carinae as in *dalmani*; principal transverse sulcus severing the median carina slightly caudad of its middle: lateral lobes as in *dalmani*, but submedian longitudinal strumose pale line narrower and more sharply etched into relief, ventral intramarginal rugose surface area more sharply evident than in *dalmani*.

Tegmina with their apices falling slightly short of those of the caudal femora, but in all other respects essentially as in *S. dalmani*.

Mesosternal lobes more sharply quadrate than in *S. dalmani*, the internal margins straighter and the meso-caudal angles more sharply defined and less rounded, the interspace between these lobes definitely quadrate, and not distinctly widening caudad as in *dalmani*; metasternal lobes virtually in contact caudad. Ovipositor jaws slightly more attenuate than in *dalmani*; ultimate sternite (subgenital plate) with median production more decided and acute than in *dalmani*.

Cephalic and median limbs as in *dalmani*: caudal femora with genicular lobes having their distal angle more distinctly acute than in *dalmani*; caudal tibiae with twelve spines on each margin.

Coloration.—General tone oil yellow, passing to sudan brown on venter and abdomen; pale medio-dorsal bar on head and pronotum, usual in this genus, apricot buff, base of humeral field of tegmina, and less definitely of marginal field, washed with same; narrow postocular line on genae, continued on the strumose ridge of the lateral lobes of the pronotum and disconnectedly on the pleura, apricot buff; broader infra-ocular bar carried across ventral portion of lateral lobes of pronotum, apricot buff, finely punctulate with mummy brown on the genae. Eyes bister; antennae argus brown, paling proximad. Discoidal vein of tegmina finely pencilled proximal with auburn. Cephalic and median limbs heavily washed with auburn; caudal femora of the general tone, genicular arches lightly infuscate; caudal tibiae and tarsi dull apricot buff, spines black tipped.

Measurements.—Length of body, 30.8 mm.; greatest length of pronotum, 6.3; greatest (caudal) width of dorsum of same, 3.4; length of tegmen, 21.8; length of caudal femur, 20.3.

The type of this striking species is unique.

CYRTACANTHACRIDINAE

Diponthus paulista new species (Pl. XII, figs. 13, 14, 15 and 16.)

This strikingly beautiful species has been compared with material of all but four of the generally recognized species of the genus, and it is quite distinct from not only these, but also from the four other forms of which no determined material is before me. Its nearest relative is clearly *D. bilineatus* Rehn,[8] from Santa Catharina, Brazil, but *paulista* can at once be distinguished by its larger size, the narrower dorsal half of the frontal costa, less protuberant eyes (as seen in cephalic aspect), less distinct transverse sulci on the prozonal disk, by the more pronounced and denser impresso-punctations of the whole pronotum, by the more ample alar organs, which surpass the apices of the abdomen and caudal femora by more than half the pronotal length, instead of merely equalling same, the blunt lobate instead of acute trigonal furcula of the male, the somewhat longer and apically more subclavate cerci of the male, the slightly more slender caudal femora, and by a number of other details, as the absence of pale lines from the humeral trunk and the anal angle of the tegmina, the more uniform olive of the whole pronotum, aside from the usual broad medio-longitudinal pale line, the deeper purple of the caudal tibiae and the presence of a rose purple wash on the tegminal apices and over all of the wings except the discal portion.

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[8] Proc. Acad. Nat. Sci. Phila., 1920, p. 246, pl. X, figs. 13 and 15, (1920).

Type.—♂ : Dourado,[9] State of São Paulo, Brazil. January 29, 1933. [Academy of Natural Sciences of Philadelphia, Type no. 5596.]

Size medium (for genus); form somewhat more elongate than in *D. bilineatus*; surface of face, most of genae, pronotum and pleura densely and cribrosely impresso-punctate, producing a decidedly rugulose surface.

Head with dorsal length equal to two-fifths that of pronotum, greatest width across eyes, in same view, equal to twice the head length: least interocular width equal to three-fourths of greatest width of fastigium, which latter is broadly scutellate, with the interocular region definitely declivent, surface shallowly concave transversely, and with the lateral fastigial margins passing smoothly into the frontal costa; fastigio-facial angle in profile broadly rounding over the definite but low interantennal area into the slightly retreating line of the lower face: frontal costa dorsad at its passage into the fastigium equal in width to three-fourths that of interocular space, the lateral margins of the costa, thence ventrad to the level of the median ocellus, subparallel, their convergence of the faintest character, ventrad of the median ocellus more distinctly and regularly convergent to the vicinity of the clypeal suture, where the costal width is no greater than half that at the passage into the fastigium; surface of frontal costa ventrad of median ocellus deeply and cribrosely impresso-punctate; lateral (accessory) facial carinae quite strongly marked, quite regularly convex laterad: genae with a narrow area immediately ventrad of the eyes and the postocular region relatively smooth and distinctly contrasted with the strongly cribroso-rugulose remainder of the genae. Eyes prominent as seen from dorsum, but less so than in *D. bilineatus,* in lateral aspect broad ovate in outline, length to breadth as 2 to 2.75. Antennae damaged.

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[9] The type specimen, for which the Academy is indebted to the kindness of Dr. Carl J. Drake, of Iowa State College, is labelled "El Dorado, Sao Paulo", which doubtless refers to the locality which in Portuguese is Dourado. This is situated to the north of the towns of Brotas and Dous Corregos, and northwest of Ityrapina. Its approximate position is 20° 8′ S., 48° 45′ W.

Pronotum with greatest (metazonal) width of disk contained one and one-half times in median length of same, median length of metazona equal to one and one-third that of prozona: cephalic margin of disk mesad broadly and very shallowly concave; caudal margin of disk as a whole obtuse-angulate, the converging margins definitely concave, immediate apex rounded; transverse sulci of prozonal disk finely and not at all conspicuously indicated, principal sulcus deeply impressed and sharply dividing the surface contour of the prozona from that of the metazona; no definite median carina, humeral shoulders of metazona definite and rectangulate in cross-section, but rounded and in no way carinate: lateral lobes of pronotum with the depth ventrad of the humeral shoulder of metazona very slightly less than dorsal length of lobes (as 5 to 5.5); cephalic margin weakly sigmoid, caudal margin very shallowly subobtusely concave, ventro-caudal angle broadly rounded, ventral margin oblique declivent cephalad, weakly convex caudad; surface rugosity closer and more involved on metazona, transverse sulci well indicated on lateral lobes.

Tegmina with greatest width contained four times in length of same, distal two-fifths evenly narrowing to the obliquely subtruncate apex: costal margin with usual proximal lobation hardly indicated, appreciably arcuate to median third, where the margin is nearly straight, gradually becoming gently arcuate thence to the distal margin, which is rounded oblique-subtruncate, the disto-sutural angle quite broadly arcuate, sutural margin nearly straight, quite so distad, feebly arcuate in proximal two-thirds: marginal field broad; anal field relatively narrow, quite extensive distad: mediastine vein pronounced, reaching to distal third of tegmina, on costal side with a number of incomplete, oblique to arcuate, anastomosing rami, a subcontinuous and distinct intercalated longitudinal nervure placed between the mediastine vein and the humeral trunk; intercalary area with a continuous but irregular, sinuous and clearly adventitious nervure present through its length, merging distad in the biseriate areolation of the distal portion of the discoidal field; anterior ulnar vein pronounced, straight proximad, subsinuate distad; anal vein strong, a pronounced axillary vein close to and subparalleling the anal vein. Wings with greatest breadth equal to half of wing length: costal margin appreciably sigmoid, distad well arcuate to the broadly rounded, yet basically rectangulate apex, marginal lobation of axillary field distinctly arcuate.

Prosternal process distinctly compressed, subcultriform, in profile appreciably retrorse, very briefly narrowing to the subacute apex: interspace between the mesosternal lobes moderately longitudinal, slightly narrower than the mesosternal lobes themselves, subcuneiform in shape, lateral margins slightly arcuate convergent caudad; interspace between the metasternal lobes subquadrate, margins slightly converging caudad. Furcula broad, flat, separated mesad by a fine median division of the bearing tergite, each branch a depressed subtrigonal plate with the internal margin tridentato-lobate, external margin sinuate, apex varying from broadly rounded to rounded acute, surface finely shagreenous: ultimate tergite (supra-anal plate) scutelliform with a sharply marked-off acute-lonceolate apical area; surface of tergite in large part with a medio-longitudinal sulcation, deeply and broadly excavate in proximal third and more narrowly and less deeply, but quite evidently, in that fourth of the tergite's length proximad of the apical area, elsewhere the sulcus is very weakly and imperfectly impressed; distal half of surface with a raised calloused area, roughly paralleling the lateral arms of the margin and separated by a distance equal to the proximal width of apical lobation of the tergite, this area divided by the median sulcus, its surface appreciably but finely shagreenous, passing evenly laterad and proximad in texture and elevation into the general tergite surface, the more lateral portions of this elevated area briefly severed from the main masses; a lower but similar and smaller subnodose area of the same surface texture lies intra-marginally briefly each side of the apical lobule, these, however, narrowly separated by surface texture (and color) from the main masses: cerci elongate, tapering, almost forcep-like in curvature as seen from dorsum, reaching appreciably distad of the ultimate tergite, in profile weakly decurved at apex, subclavate by the brief but acute-angulate production of the ventral side of the apex, which is arcuato-subtruncate distad: ultimate sternite (subgenital plate) subcompressed, subrostrate, subnaviculiform in cross-section with greatest width definitely ventrad, lateral margins as seen from dorsum evenly and moderately straight convergent distad, dorsal margin of apex in same view narrowly rounded; in profile the dorsal margin of this sternite is seen to be nearly straight, apex in same view faintly acute, rounded, proximo-ventral surface of sternite less heavily chitinized and puckered in drying, as is characteristic of the genus, the median differentiation of this tergite from the penultimate one is indefinite as in the congeneric species, while it is clearly marked and strongly concave laterad.

Cephalic and median limbs relatively short and of the type usual in the genus. Caudal femora falling slightly short of the abdominal apex, rather slender (for genus), greatest depth contained slightly more than five times in the femoral length (as 3 to 15.5); pattern of the external pagina quite deeply etched: caudal tibiae relatively heavy, ten to eleven external, eleven to twelve internal spines: caudal tarsi with proximal and distal articles subequal in length, the former appreciably depressed.

Coloration.—General tone yellowish olive, becoming buffy citrine on the sterna and paling to isabella color on the abdomen, the tegmina with the greenish of their proximal halves Scheele's green (of Ridgway), almost clear emerald green on the anal field; broad medio-longitudinal bar on hind and pronotum ochraceous-tawny. Head with pale median bar as broad as the full interocular width at the vertex, passing over on the frontal costa and becoming obsolete interantennally, fuscous cloud borderings to the pale bar evident on the fastigium and occiput; eyes ochraceous-tawny dotted with fuscous. Pronotum with pale bar on metazona equally wide to the portion on the head, on the prozona slightly but appreciably narrower, fuscous bordering wash sharp at margin of contact, laterad obsoletely passing into the yellowish olive of the remainder of the pronotum. Tegmina with the proximal greenish distad washed with old rose, the anal field in its entirety and the marginal field more weakly continuing the green distad than the discoidal field, which is definitely rose tinted, principal venation, as well as most of the subsidiary neuration, of all but the anal field, pencilled with mummy brown to chestnut-brown, venation of anal field not differentiated from the general green of that area except that the axillary vein is slightly infuscate proximad. Wings with anterior and axillary fields strongly washed with eugenia red (of Ridgway), the same tone faintly tinging the adjacent portion of the radiate field and the veins therein, remainder of radiate disk semi-opaque whitish yellow, veins not differentiated in color, principal longitudinal veins of anterior and axillary fields definitely pencilled with deep maroon. Cephalic and median limbs dull analine yellow: caudal femora dull analine yellow, mediolongitudinal line on external pagina blue-black, internal face with ventro-internal carina deep burnt lake, genicular lobes distad and dorsal surface of the genicular extremity clouded with deep olivaceous-fuscous: caudal tibiae and tarsi deep burnt lake, tibial spines narrowly black tipped. Antennae lacking.

Measurements.—Length of body, 34.8 mm.; length of pronotum, 8.1; greatest (caudal) width of pronotal disk, 5.3; length of tegmen, 30.1; greatest width of tegmen, 7; length of caudal femur, 18.

The type of this most distinctive and unusual species is unique.

EXPLANATION OF FIGURES

PLATES XI AND XII

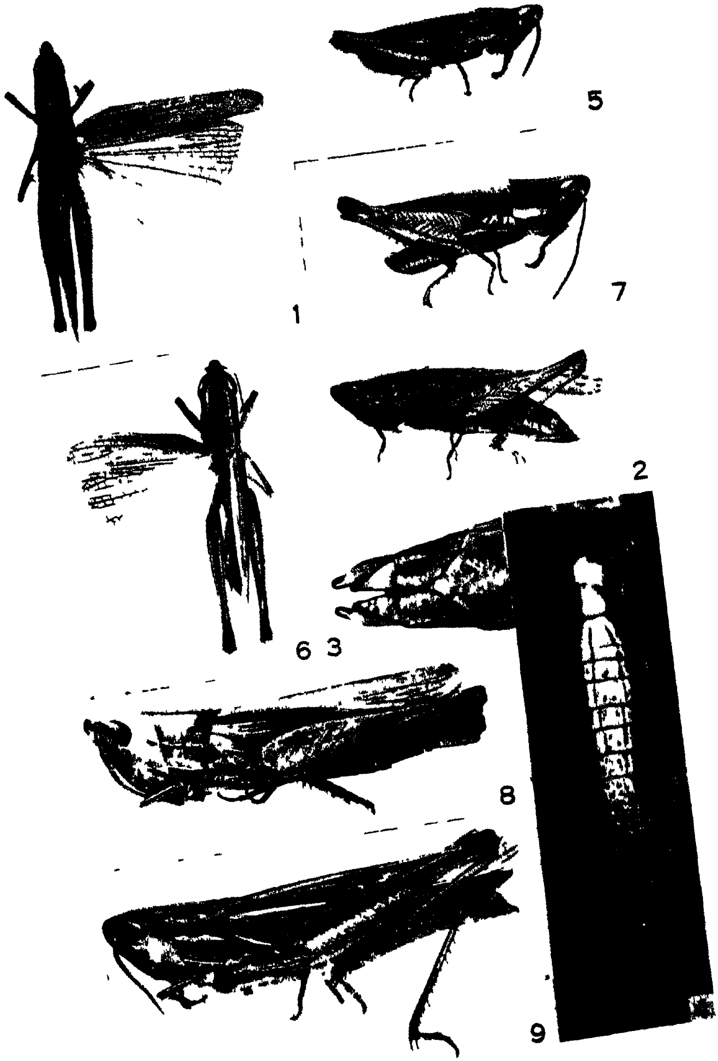
Laplatacris dispar new genus and species. Female (type); Buenos Aires, Argentina. Fig. 1.—Dorsal view (× 2). Fig. 2.—Lateral view (× 2). Fig. 3.—Ventral aspect of ultimate sternite (subgenital plate) (much enlarged). Fig. 12.—Cephalic view of head (much enlarged). Female paratype; Estación José C. Paz, Argentina. Fig. 4.—Antennae (greatly enlarged). Male (allotype); Buenos Aires. Fig. 5.—Lateral view (× 2).

Amblytropidia sola new species. Male (type); Nova Teutonia, Santa Catharina, Brazil. Fig. 6.—Dorsal view (× 2). Fig. 7.—Lateral view (× 2).

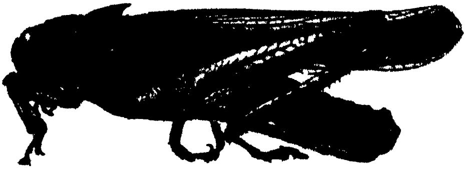
Sinipta acuta new species. Female (type); Rio Grande do Sul, Brazil. Fig. 8.—Lateral view (× 2). Fig. 10.—Dorsal view (× 2).

Sinipta dalmani Stål. Female; Carcaraña, Argentina. Fig. 9.—Lateral view (× 2). Fig. 11.—Dorsal view (× 2).

Diponthus paulista new species. Female (type); Dourado, São Paulo, Brazil. Fig. 13.—Dorsal view (× 1⅜). Fig. 14.—Lateral view (× 1⅜). Fig. 15.—Cephalic aspect of head (× 4). Fig. 16.—Dorsal view of apex of abdomen (× 4).



REHN—NEW SOUTH AMERICAN ACRIDIDAE



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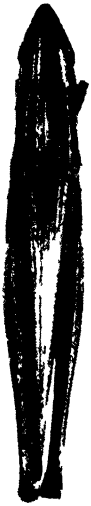

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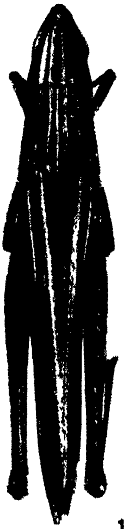

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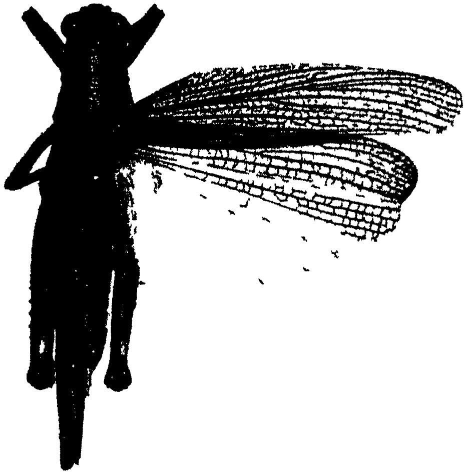

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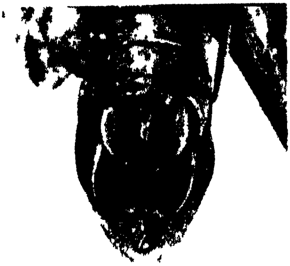

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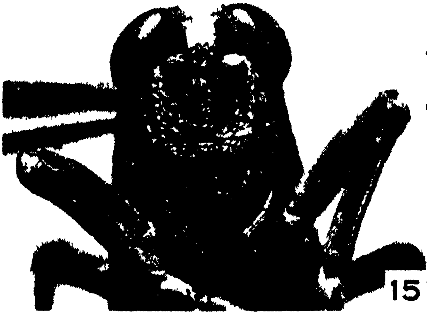

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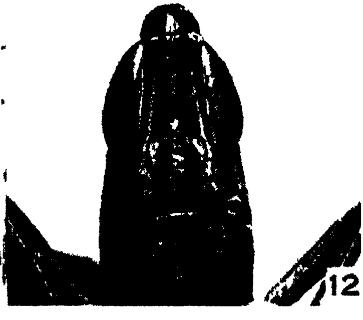

12

REHN—NEW SOUTH AMERICAN ACRIDIDAE

THE GENUS DOLICHOPUS IN COLORADO

(DIPTERA, DOLICHOPODIDAE)

BY MAURICE T. JAMES
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The genus *Dolichopus* is one of the largest of the genera of Diptera in the Holarctic region, being represented by more than two hundred fifty species in North America and by an approximately equal number in Eurasia. The genus has been admirably monographed for the Nearctic Region by Van Duzee, Cole, and Aldrich,[1] and the keys have been brought up to date by Van Duzee and Curran.[2] Thanks to the excellent figures of Dr. Cole and the well constructed keys and descriptions of the above cited works, the student can with a little practice make identifications with fair certainty. I have omitted keys from the present work since they would be for the most part only a fragmentary adaptation of those of Van Duzee and Curran.

Dolichopus is rich in species in Colorado. In the literature I find records of thirty-nine species, and a study of several thousand specimens in the collections of the University of Colorado and the Colorado State College, upon which the present paper is based, has added eighteen more described species together with six which are herein described for the first time. The list includes collections made at the University of Wyoming Camp and Snowy Range in extreme Southern Wyoming.

Holotypes and allotypes of new species are in the Academy of Natural Sciences of Philadelphia. Paratypes of all new species are to be found in the collection of the Colorado State College.

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[1] Bull. U.S. Nat. Mus. no. 116, (1921).

[2] Amer. Mus. Nov., nos. 683 and 684, (1934).

In the following list, certain locality records are taken from the literature; these are so indicated. Other records are based on specimens determined by myself. For the collection of this material, I am especially indebted to my wife, Helen B. James, and to Messrs. Urless Lanham and R. Bauer, students in the University of Colorado.

1. **Dolichopus barbaricus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 41, 1921. [Colorado; *type series.*]

Not since recorded from the state.

2. **Dolichopus viridis** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 44.

Fairplay, Jefferson, Salida, Poncha Springs, and Saguache, August 1-3, 1938, (James & Lanham); Lindland, July 27, 1938, (James); Fort Collins, June 16, 1938, (James); and Roggen, July 6 & 7, 1937, (James & Moss). Numerous specimens.

3. **Dolichopus nigricauda** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 46, 1921. [Colorado; *type* and *allotype.*]

Saguache and Poncha Springs, August 3 & 4, 1938, (James & Lanham); Fort Collins, June 16, 1938, (James); and Lyons, July 9, 1937, (James). Thirty specimens.

4. **Dolichopus myosota** Osten Sacken

Biol. Centr. Amer., Dipt. I, p. 213, 1887.

Roggen, August 31, 1938, (James), 1 ♂, 4 ♀.

5. **Dolichopus multisetosus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 49, 1921. [Tennessee Pass; *paratype.*]

Pingree Park, August 11, 1937, (James); Grand Mesa, July 10, 1938, (Bauer); and Snowy Range, Wyoming, August 15, 1938, (James). Nineteen specimens.

6. **Dolichopus enigma** Melander and Brues

Biol. Bull., I, p. 139, 1900. [North Park; *holotype.*] Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 52, 1921. [Marshall Pass.]

Trail Ridge Road, Rocky Mt. Nat. Park, July 28, 1938, (M. & H. James), 16 ♂, 4 ♀.

The female of this species has not been described. My specimens differ from the males only in the usual primary and secondary sexual characters. In the Van Duzee and Curran Key, they run to *multisetosus*, Couplet 43, and I can not positively separate the two. My female *enigma* have two bristles on the upper side of the posterior basitarsi and the last section of the fourth vein is but slightly bent, as in Dr. Cole's illustrations of the wing of the male. My Pingree Park specimens of *multisetosus* have three or four bristles on the basitarsi and the bend in the fourth vein is more pronounced (see Dr. Cole's illustration of the male of *multisetosus*); yet the Snowy Range specimens associated with a male of *multisetosus* agree with my females of *enigma* in these respects. It is possible that, in spite of the association, the Snowy Range females may be *enigma*.

7. **Dolichopus adaequatus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 53, 1921. [Colorado, no locality, and Victor; *paratypes*.]

Roggen, May 19, 1934, (James) and May 29, 1937, (Elizabeth M. Heiss, M. T. & H. B. James); Science Lodge, near Boulder, June 9, 1932, (James); Boulder, June 28, 1933, (James); Fort Collins, June 14, 1938, (James); LaPorte, June 9, 1938, (James); Lindland, July 27, 1938, (James); Jefferson, August 1, 1938, (James & Lanham); Eckert, June 28, 1938, (Lanham); 7 miles south of Glade Park, June 19, 1938, (Lanham, Bauer). Thirty specimens.

8. **Dolichopus manicula** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 56, 1921. [Marshall Pass; *holotype*. Tennessee Pass; *paratypes*.]

Divide, July 19, 1937, (M. & H. James) 1 ♀. Kenosha Pass, August 1, 1938, (James & Lanham), 3 ♂, 3 ♀.

9. **Dolichopus acuminatus** Loew

Neue Beitr., VIII, p. 12, 1861.

Boulder, Fort Collins, Roggen; May to September. Twenty specimens.

10. **Dolichopus conspectus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 65, 1921. [Colorado, no locality.]

Fort Collins, June 9 to August 31, (M. & H. James); Delta, June 25 to July 5, (Lanham). Twenty-four specimens. This species is erroneously called " *conspicuus* V.D." in the Van Duzee and Curran key.

11. **Dolichopus barbicauda** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 76, 1921. Van Duzee and Curran, Amer. Mus. Nov., no. 683, p. 7, 1934. [Colorado.]

Not since recorded from the state.

12. **Dolichopus xanthocnemus** Loew

Mon. Dipt., No. Amer., II, p. 31, 1864. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 84, 1921. [Colorado.]

Not since recorded from the state.

13. **Dolichopus partitus** Melander and Brues

Biol. Bull., I, p. 135, 1900. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 87, 1921. [Colorado, no locality; *holotype*. Marshall Pass; *paratypes*.]

14. **Dolichopus groenlandicus** Zetterstedt

Dipt. Scand., II, p. 528, 1843. Van Duzee, Bull. U.S. Nat. Mus, no. 116, p. 94, 1921. [Colorado.] Aldrich, Proc. U.S. Nat. Mus., LXI (25), p. 2, 1922. [Tennessee Pass.]

University of Wyoming Camp, August 15, 1938, (James), 1 ♂.

15. **Dolichopus solidus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 104, 1921. Aldrich, Proc. U.S. Nat. Mus., LXI, (25), p 2. [Tennessee Pass.]

Not since recorded from the state.

16. **Dolichopus amnicola** Melander and Brues

Biol. Bull, I, p. 130, 1900. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 105, 1921. [North Park, *holotype*.]

Cowdrey, July 27, 1938, (James), 1 ♂; Saguache, August 3, 1938, (James & Lanham), 6 ♂, 1 ♀.

16a. **Dolichopus amnicola** var. **robertsoni** Curran

Dolichopus robertsoni Curran, Canad. Ent., LV, p. 191, 1923.

Saguache, August 3, 1938 (James & Lanham), 8 ♂, 6 ♀.

This form was described as *D. robertsoni;* but Doctor Curran stated that it was possibly a variety of *amnicola.* The distinctions given in the original description were the more extensively yellow legs, the longer cilia of the posterior femora, and the more compressed middle tarsi of *robertsoni.* In the series before me, I find considerable variation in these three points. In regard to leg color, the anterior femora range from entirely yellow (*robertsoni*) to almost entirely black (*amnicola*). I should therefore regard *robertsoni* as a rather poorly defined variety of *amnicola.*

17. **Dolichopus varipes** Coquillett

Proc. Wash. Acad. Sci., II, p. 425, 1900. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 109, 1921.

Pingree Park, July 11, 1937, (James); 1 ♂. University of Wyoming Camp, August 15, 1938, (James), 6 ♂, 11 ♀.

18. **Dolichopus affluens** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 114, 1921.

Pingree Park, July 11, 1937 (James), 1 ♂, 4 ♀.

19. **Dolichopus barbipes** Van Duzee

Bull. U.S. Nat. Mus, no. 116, p. 114, 1921.

Roggen, July 6-7, 1937 (James & Moss), 1 ♀.

20. **Dolichopus ramifer** Loew

Neue Beitr., VIII, p. 19, 1861. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 147, 1921. [Greeley; Colorado Springs]

Fort Collins, Greeley, La Porte, Roggen, Lyons, Grover, Nederland, Walsenburg, Alamosa, Salida, Saguache, Pueblo, Delta, Eckert, Grand Junction, University of Wyoming Camp; June to August. Very abundant.

21. **Dolichopus renidescens** Melander and Brues

Biol. Bull., I, p. 143, 1900. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 157, 1921. [North Park.]

Boulder, May 24, 1934 (A. L. Hays) 3 ♂; Nederland, July 9, 1932 (James) 1 ♂; Monument, August 6, 1938 (James & Lanham) 1 ♂; La Porte, May 21, 1936, 1 ♂; Divide, July 19, 1937 (M. & H. James), 1 ♂, 1 ♀; Jefferson, August 1, 1938 (James &

Lanham), 1 ♂, 1 ♂, Alamosa, August 4, 1938 (James & Lanham), 1 ♂; Saguache, August 4, 1938 (James & Lanham), 2 ♂, 2 ♀.

22. **Dolichopus jugalis** Tucker

Trans. Kansas Acad. Sci., xxiii, p. 160, 1911. [Tabernash; *holotype.*]

Not since recorded from the state.

23. **Dolichopus obcordatus** Aldrich

Kansas Univ. Quart., ii, p. 14, 1893. [Manitou; *cotype.*] Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 173, 1921. [Colorado Springs.]

Fort Collins, La Porte, Boulder Nederland, Pingree Park, Gold Hill, Raymonds, Fairplay, Kenosha Pass, Buena Vista, Lindland, Cowdrey, Walden, Divide, Florissant, Salida, Saguache, Eckert, Glade Park: June to August. Numerous specimens.

24. **Dolichopus blandus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 176, 1921. [Tennessee Pass; *holotype*]

Kenosha Pass, August 1, 1938, (James & Lanham), 6 ♀; Pingree Park, July 11, 1937 & July 9, 1938, (James), 4 ♂, 3 ♀; Webster, August 1, 1938, (James & Lanham), 1 ♂; Lindland, July 27, 1938, (James), 1 ♂; Science Lodge, near Ward, July 9, 1932, (James), 3 ♂.

25. **Dolichopus flagellinitens** Wheeler

Psyche, v, p. 339, 1890. Aldrich, Kans. Univ. Quart., ii, p. 13, 1893. [Colorado.] Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 179, 1921.

Not since recorded from the state.

26. **Dolichopus bifractus** Loew

Neue Beitr., viii, p. 19, 1861.

Boulder, June 19-25, 1933, (James), 1 ♂, 1 ♀; Canon City, August 11, 1 ♂; Fort Collins, May 29, 1936, and June 18, 1938, (M. & H. James), 1 ♂, 1 ♀; Alamosa, August 12, 1934, (James), 1 ♂; Salida, August 3, 1938 (James & Lanham), 1 ♀.

27. **Dolichopus plumipes** Scopoli

Musca plumipes Scopoli, Ent. Carniolica, p. 334, 1763.

Boulder, Nederland, Pingree Park, Lindland, Walden, Cowdrey, Raymonds, Ward, Kenosha Pass, Shaffer's Crossing, Jefferson, Fairplay, Divide, Florissant, Monument, Saguache, Glade Park. Very abundant.

28. **Dolichopus longimanus** Loew

Neue Beitr., VIII, p. 14, 1861.

Pingree Park, July 11, 1937, (James), 1 ♂ ; Lindland, July 27, 1938, (James), 1 ♂ .

29. **Dolichopus amplipennis** Van Duzee

Bull. U.S. Nat. Mus, no. 116, p. 197, 1921. [Colorado; *types.*]

Not since recorded from the state.

30. **Dolichopus splendidus** Loew

Neue Beitr., VIII, p. 21, 1861. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 199, 1921. [Colorado.]

Not since recorded from the state.

31. **Dolichopus nigricornis** Meigen

Syst. Beschr., IV, p. 82, 1824.

Pingree Park, July 11, 1937, (James), 6 ♂ , 5 ♀ ; Webster, August 1, 1938, (James & Lanham), 4 ♀ ; Kenosha Pass, August 1, 1938, (James & Lanham).

This species appears as *D. discifer* Stannius in the Van Duzee, Cole, & Aldrich monograph; but as Becker[3] and Aldrich[4] have pointed out, *discifer* is a synonym of *nigricornis.*

32. **Dolichopus walkeri** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 207, 1921. [Longview; *type, paratypes.*]

Fort Collins, June and July; Pingree Park, Poncha Springs, Florissant, Saguache, and Alamosa, August; Delta, July 2, (Lanham & Bauer). Abundant.

This species traces correctly in the Van Duzee, Cole, and Aldrich keys and in the Van Duzee and Curran key to the females, except that there it may be confused with *procerus,* since the bend in the last section of the fourth vein is usually before the middle. In the Van Duzee and Curran key to the males, however, the name *walkeri* in couplet 266 has been replaced by *speciosus.* Whether this is an error or whether the authors considered the two species synonymous, I do not know. In the series before me, however, *speciosus* and *walkeri* are readily separable, and I can not consider them synonyms. Specimens of *D. walkeri* were taken at Rudolph's Slough near Fort Collins, resting upon mesophytic vegetation, in a wooded area, some distance from the water. Most of the one-hundred-fifty specimens in our collection, however, were taken in sedge and grass meadows near the water's edge.

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[3] Abh. Zool-Bot. Ges. Wien, XIII, p. 15, (1922).

[4] Proc. U.S. Nat. Mus., LXI (25), p. 4, (1922).

33. **Dolichopus speciosus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 208, 1921. [Geneva Park, Grant; *paratypes*.]

Divide, July 19, 1937, (M. & H. James); Pingree Park, July 11, 1937, (James); Walden, and Lindland, July 27, 1938, (James); seven miles south of Glade Park, June 23, 1938, (Lanham). Twenty-eight specimens.

The female, which has not previously been described, agrees quite well with the males, except for the usual sexual differences, primary and secondary. The fore tarsi are but slightly longer than their tibiae and are entirely black, except for a very slight trace of yellow at the base; the proportional length of the segments is 16:7:5:4:5. The front coxae are more or less blackened externally at the base. In the Van Duzee and Curran key, it traces to *procerus* in couplet 219, or possibly also to *procerus* in couplet 208, but it may be distinguished from both *procerus* and *walkeri* by the blackening of the front coxae and by the entirely black front tarsi.

34. **Dolichopus procerus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 209, 1921. [Colorado, *type, allotype*.]

Walden, July 27, 1938, (James), 1 ♂, 4 ♀.

35. **Dolichopus aeratus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 211, 1921. [Colorado; *type*.]

Not since recorded from the state.

36. **Dolichopus sufflavus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 213, 1921. [Colorado; *paratype*.]

Not since recorded from the state.

37. **Dolichopus coloradensis** Aldrich

Kansas Univ. Quart., II, p. 26, 1893. [Colorado; *types.*]

Five miles northwest of McCoy, July 13, 1938, (Lanham), 2 ♂.

38. **Dolichopus lobatus** Loew

Neue Beitr., VIII, p. 24, 1861.

Fort Collins, July 10-18, 1935, (James), 14 ♂, 6 ♀; Fort Collins, June 30 and July 2, 1931, 2 ♀; Boulder, July 5, 1933, (James), 1 ♂; Boulder, June 19, 1933, (James), 1 ♀.

39. **Dolichopus amphericus** Melander and Brues

Biol. Bull., I, p. 146, 1900. Van Duzee and Curran, Amer. Mus. Nov., no. 683, p. 17. [Colorado.]

Not since recorded from the state.

40. **Dolichopus afflictus** (Osten Sacken)

Hygroceleuthus afflictus Osten Sacken, West. Dipt., p. 313, 1877.

Fort Collins, July and August; Pueblo, August 5, 1938, (James & Lanham); Roggen, July and August. Numerous specimens.

41. **Dolichopus consanguineus** (Wheeler)

Hygroceleuthus consanguineus Wheeler, Proc. Calif. Acad. Sci., II, p. 5, 1899 Van Duzee, Bull. U.S. Nat Mus., no. 116, p. 222, 1921. [Colorado.]

Masonville, Sept. 4, 1934 1 ♂, 1 ♀; Pingree Park, August 1-19, 1934, (M. & H. James), 1 ♀.

42. **Dolichopus idahoensis** (Aldrich)

Hygroceleuthus idahoensis Aldrich, Kans. Univ. Quart., II, p. 154, 1893. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 225, 1921. [Colorado.]

Olney Springs, Sept. 1, 1932, (James), 2 ♀; Canon City, July 22, 1931, 1 ♀.

43. **Dolichopus penicillatus** Van Duzee

Bull. U.S. Nat. Mus., no. 116, p. 227, 1921.

Fairplay, Saguache, Schaffer's Crossing, and Monument, (James & Lanham); Fort Garland, Cowdrey, Lindland, Walden, (James); Florissant, (M. & H. James); July and August. Numerous specimens.

In most of my specimens, the preapical bristle of the hind femur is preceded by a row of shorter bristles, as in *aldrichi.*

The females, therefore, run to *aldrichi* in couplets 165 and 237 of the Van Duzee and Curran key, and I have not found a means of distinguishing them.

44. Dolichopus bakeri Cole

Jour. Ent. Zool., IV, p. 839, 1912.

Roggen, May 19, July 8, August 31, and Sept. 8; Lyons, July 9, 1937, (James); Fort Collins, June 6, 11 & 14, July 11 & 18, Oct. 5, (M. & H. James); Grover, June 10, 1937, (M. & H. James); Greeley, July 19, 1938, (James); Pueblo, Aug. 5, 1938, (James & Lanham); Saguache, August 3, 1938, (James & Lanham). Numerous specimens.

This series before me agrees, in general, with the descriptions and figures in the Van Duzee, Cole, and Aldrich monograph. The number of preapical bristles on the middle and hind femora, however, is variable; these may be either one or two; when two, the more basal one may be feeble. In an occasional specimen, the terminal section of the fourth vein may be bent abruptly and with a spur, as in *ramifer*.

45. Dolichopus celeripes Van Duzee

Bull. U.S Nat. Mus., no. 116, p. 243, 1921. [Colorado; *paratype*.]

Not since recorded from the state.

46. Dolichopus aldrichi (Wheeler)

Hygroceleuthus aldrichi Wheeler, Proc. Calif. Acad. Sci., II, p 3, 1897. Van Duzee, Bull. U.S. Nat. Mus., no. 116, p. 248, 1921. [Colorado]

Walden, July 27, 1938, (James), 2 ♂; Lindland, July 27, 1938, (James), 1 ♂; Pingree Park, August 19-22, 1935, (M. & H. James), 1 ♂.

47. Dolichopus coquiletti Aldrich

Kans. Univ. Quart., II, p. 19, 1893. Van Duzee, Bull. U S. Nat. Mus, no. 116, p. 269, 1921. [Colorado.]

Delta, July 27, 1938, (Lanham), 1 ♂, 1 ♀.

48. Dolichopus cuprinus Wiedemann

Auss. Zw. Ins., II, p. 230, 1830.

Canon City, July 22, 1931, 7 ♂; Fort Collins, July 18, 1938, (James), 1 ♂, 1 ♀.

49. Dolichopus albertensis Curran
Canad. Ent., LIV, p. 286, 1922.

Pingree Park, July 9, 1938 and July 11, 1937, (James), 6 ♀.

50. Dolichopus maculitarsis Van Duzee
Psyche, XXXII, p. 184, 1925.

Roggen, May 19, 1934, (M. & H. James), May 29, 1937, (M. & H. James, Elizabeth M. Heiss), and July 6, 1937, (James & Moss), 4 ♂, 10 ♀.

Close to *appendiculatus*, but distinguished by the pale middle and hind femora and lack of the bristle-like appendage of the middle tibiae. The illustration of the wing of *appendiculatus* in the Van Duzee, Cole, and Aldrich monograph [5] will serve for this species.

This species was described from two females. I can find no description of the male, although the Curran and Van Duzee key places it correctly. The following description is based on the Roggen males.

Male. Face broad, extending slightly below the eyes, densely yellowish-brown pollinose; front and vertex shining green. Antennae of ordinary size; the first segment yellow, narrowly black above; the second black on the upper, yellow on the lower half; the third black, rather short, somewhat pointed, the arista inserted at about the middle of the dorsal surface. Proboscis brown; palpi light yellow. Infra-orbital bristles white; about eight of the upper ones black. Thorax bright green; the dorsum with scant yellowish pollen, the pleura with distinct whitish pollen; abdomen bright green; the thorax and abdomen with bluish reflections in certain lights. Genitalia black, the first segment with somewhat greenish reflections; the lamellae moderately large, subtriangular, the apical side rather rounded, jagged, bristly; in color yellowish white, the apex blackened Coxae entirely black, the front one greenish outwardly; trochanters black; front femora black, with greenish reflections, their broad apices, however, yellow; middle and hind femora yellow, the middle ones somewhat blackened below on the basal third, the hind ones slightly blackish at the extreme base; the middle and hind femora each with a single preapical bristle, the hind one not ciliated below. Front tibiae blackish except basally; middle tibiae yellow, with the somewhat enlarged apex blackish; hind tibiae thickened, entirely deep black. Front tarsi blackish, except base of basitarsi, not ornamented, about as long as their tibiae, the segments in the ratio 15:7:5:3:4; middle tarsi considerable longer than their tibiae, the ratio (same units as above) being 45:68, that of the individual tarsal segments 25:15:11:9:8; the segments yellow, each one definitely enlarged and blackened at the apex. Hind tarsi wholly deep black; ratio of tibiae and individual tarsal segments 50:21:22:14:10:9. Wings grayish; costa with a prominent enlargement along its basal third, as in *appendiculatus;* last section of fourth vein bent strongly at its middle; wings narrow, parallel-sided, without lobes or sinuses on their posterior margin. Calypters yellow, the cilia black and of ordinary thickness. Length, 5–5.5 mm.

51. **Dolichopus nigrilineatus** Van Duzee
Canad. Ent., LVI, p. 248, 1924.

Pingree Park, July 9, 1938, (James), 1 ♂.

52. **Dolichopus nigroapicalis** Van Duzee
Pan-Pac. Ent., VI, p. 125, 1930. [Long's Peak Inn; *types*]

Not since recorded from the state.

53. **Dolichopus parvimanus** Van Duzee
Amer Mus. Nov., no. 599, p. 16, 1933. [Regnier; *type*.]

Not since recorded from the state.

54. **Dolichopus bruneifacies** Van Duzee
Amer. Mus. Nov., no. 599, p. 14, 1933. [Electra Lake; *types*]

Not since recorded from the state.

55. **Dolichopus fallax** Van Duzee
Amer. Mus. Nov., no. 599, p. 14, 1933. [Electra Lake; *types*.]

Not since recorded from the state.

56. **Dolichopus elegans** Aldrich
Proc. U.S. Nat. Mus., LXI, (25), p. 12, 1922. [Tennessee Pass; *types*.]

57. **Dolichopus longus** Aldrich
Proc. U.S. Nat. Mus., LXI, (25), p. 13, 1922. [Tennessee Pass; *types*.]

58. **Dolichopus helenae** new species

The males trace to *albiciliatus* Loew, couplet 93, of the Van Duzee and Curran key, but the broad face, modified fore tarsi and the form of the genital lamellae, among other things, will readily separate the two. The female runs to couplet 80 of the Van Duzee and Curran key; but the middle tarsi, the antennae, and the cilia of the calypters are wholly black.

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[5] Bull. U.S. Nat. Mus., no. 116, pl. 3, fig. 33.

Male. Head dull black, with slight bronze reflections, especially noticeable on the front. Face very broad, fully half as broad as long, somewhat narrowed below, densely covered with yellowish-gray pollen. Infra-orbital bristles white, about six above black. Antennae wholly black, of normal size; third segment about as long as wide, somewhat angular at apex, the arista inserted near the middle of the dorsal surface. Proboscis black; palpi bright yellow. Thorax black, with bronze reflections, grayish pollinose, rather densely so on the pleura; bristles not especially strong. Abdomen black, with bronze reflections, in large part covered with inconspicuous grayish pollen. Genitalia black; lamellae of normal size, oval, but very slightly jagged at apex; brown, becoming black at apex and somewhat yellowish at base, fringed with uniform, moderately short, black hairs. Coxae black with rather dense gray pollen, the front ones with short black hairs and the usual black bristles. Femora black, with prominent yellow apices; middle and hind femora each with one preapical bristle; hind femora fringed below on the apical half with black cilia which are about as long as the maximum width of the femora. Tibiae yellow, the front and middle ones brownish, the hind ones black at the apex; hind tibiae somewhat larger than the others and thickened at the apex, but not any more so than in most members of this genus. Segments of front tarsi in the ratio 21:9:6:4:6; fourth and fifth segments flattened; the fifth bilobed, the outer lobe much longer than the inner; first three segments yellow, the fourth and fifth black, with some grayish pollen. Middle and hind tarsi black, the hind basitarsi thickened, with three bristles above. Wings uniformly grayish; costa slightly thickened at apex of first vein; last section of fourth vein bent just before its middle; posterior margin without lobes or sinuses. Calypters and halteres yellow; cilia of calypters black. Length, 5 mm.

Female. Similar to male except sexually; front tarsi black except basal half of basitarsi; ratio of segments 17:8:5:4:4.

Holotype.—Male; Trail Ridge Road, Rocky Mountain National Park, Colorado; 12,200 feet; July 29, 1938; (M. T. & H. B. James).

Allotype, female; *paratopotypes,* 1 ♂, 8 ♀; with same data.

59. **Dolichopus calvimontis** new species

This species is close to *fortis* Aldrich. In the Van Duzee and Curran key, the male traces to *fortis* in couplet 33, but the cilia of the hind femora are black. The female runs to *corax,* couplet 34, except that the bristle on the middle basitarsi is not large, as indicated in couplet 33.

Male. Head dull black, the front with bronze reflections. Face moderately wide, about a third as wide as long, densely yellow pollinose. Infra-orbital bristles wholly black. Antennae black of normal size, third segment about as long as wide, rounded apically, the arista inserted at the apical third of the dorsal surface. Proboscis and palpi black. Thorax black, with bronze reflections, lightly covered with grayish pollen which is somewhat more yellowish dorsally. Abdomen black with bronze reflections; pollen evenly distributed, grayish, moderately abundant but inconspicuous; genitalia black; lamellae oval, somewhat jagged apically, whitish with a conspicuous black border, fringed with white hairs above and black hairs apically and below, those at the jagged apex being more conspicuous and somewhat flattened. Legs entirely black, the knees with but the slightest trace of yellow; fore tarsi not ornamented, the ratio of the segments 25:11:7:5:5; middle and hind femora each with one preapical bristle; the hind femora fringed with long black cilia below on the median third; hind tibiae somewhat thickened; hind basitarsi with five or six strong bristles above; ratio of segments of hind tarsi 43:24:15:10:6. Wing grayish-hyaline; costa slightly enlarged at apex of first vein; bend in last section of fourth vein at the middle, quite gentle; posterior margin uniformly curved, without lobes or sinuses. Halteres and calypters yellow, the cilia of the latter black. Length, 6 mm.

Female. Similar to the male, with the ordinary sexual variations. Middle basitarsi with a small bristle above, beyond the middle.

Holotype.—Male; Trail Ridge Road, Rocky Mountain National Park, Colorado; 12,200 ft.; July 29, 1938; (M. T. & H. B. James).

Allotype, female; *paratopotypes,* 1 ♂, 2 ♀; with same data.

60. **Dolichopus magnantenna** new species

The males trace to *bakeri,* couplet 278, of the Van Duzee and Curran key; the females trace best to *californicus,* couplet 229 (imperfectly so, since the front coxae are blackened only posteriorly, but the blackening is not in the form of a band). The closest relationship is to *crenatus,* but the antennae are wholly black; in the male, the first segment is not so broad, the second lacks the inner tubercular projection, and the arista is not so thick; the wing of the male has a more prominent thickening at the apex of the first vein, and the bristles of the posterior femora are different.

Male. Head dark green. Front with purplish reflections; face moderately narrow, about one-fourth as wide as long, densely silvery pollinose; infra-orbital bristles white, about ten above black; antennae wholly black; proboscis black; palpi pale lemon yellow to white. Antennae very large; first and second segments subequal in length, each twice its maximum width and twice the length of the third, which is as long as wide; first segment narrower at the base than at apex; second parallel-sided; third rounded apically, the somewhat thickened arista inserted near its basal third. Thorax bright green, shining, with faint purplish reflections in certain light; dorsum lightly yellowish pollinose; pleura rather densely whitish pollinose. Abdomen shining green, with slight purplish or sometimes bronze reflections under certain light. Genitalia black; lamellae of moderate size, broadly oval, almost circular, somewhat jagged apically, light yellow to white with a narrow, but well defined black posterior border, and fringed with black hairs which are bristly apically. Front coxae yellow, more or less blackish to greenish externally, this area poorly defined and variable in extent, but usually occupying the basal half externally; middle and hind coxae blackish green, with narrow yellow apices; femora wholly yellow, the middle ones with one (rarely two) preapical bristles, the hind ones not ciliated below, usually with three equally strong, widely separated bristles on the apical half (these are subject to variation, however). Tibiae wholly yellow; all basitarsi yellow, except apices; tarsi otherwise black; all tarsi simple; ratio of segments of front tarsi 14:6:5:4:4. Wings short, broad; costa conspicuously thickened at apex of first vein; bend of last section of fourth vein rather gentle, just before middle of section; posterior margin with a small sinus at apex of fifth vein, otherwise evenly rounded. Halteres and calypters yellow; cilia of calypters black. Length, 5 mm.

Female. Similar to male, except in the usual sexual variations. Antennae large for a female; ratio of segments 7:5:4 (male, on same scale, 10:10:5). Middle femur with one, hind one with two, preapical bristles; middle basitarsi without bristles above.

Holotype.—Male; Fairplay, Colorado; August 2, 1935; (James & Lanham).

Allotype, female; *paratopotypes,* 6 ♂, 4 ♀; with same data.

61. **Dolichopus pingreensis** new species

The male runs in the Van Duzee and Curran key to *flaviciliatus,* couplet 124; the female runs to couplet 121 but does not fit either alternative, since the cilia of the calypters are wholly yellow and the middle tibia has one bristle above. This species is close to *flaviciliatus,* and Dr. Cole's illustrations of the wing, antennae, and genital lamellae will suffice for *pingreensis,* except that in this species the lamellae are more nearly triangular in outline. *Pingreensis* may be distinguished by its silvery face and wholly yellow anterior coxae. It is possibly only a subspecies of *flaviciliatus.*

Male. Front and occiput bright green, with bronze reflections; face one-third as broad as long, densely silvery pollinose; infra-orbital cilia white, about six of the upper ones black; proboscis black; palpi yellow. Antennae wholly black, the first segment slender, of moderate length; the second short, especially externally; the third large, broad, as long as the first and second combined, slightly pointed apically, the arista inserted near its apex. Thorax green with bronze reflections, rather bristly, the pollen white, almost invisible dorsally but distinct on the pleura. Abdomen green with slight bronze reflections; genitalia black, their lamellae of moderate size, subtriangular but rounded below, jagged apically, white with a distinct black apex, fringed with white hairs above and at the base below, otherwise with black hairs and the usually bristly hairs at the apex. Anterior coxae yellow; middle and hind ones black, with the narrow apex yellow; femora yellow, the middle and hind ones each with one preapical bristle, the hind ones fringed below except on the basal fourth with long yellow cilia; tibiae yellow, the hind ones distinctly blackened on the apical fourth and thickened; and front and middle tarsi blackened from the apex of the basitarsi, the hind ones wholly black; all tarsi plain; ratio of segments of front tarsi 12:6:5:3:4; hind tarsi somewhat thickened. Wings rather narrow; costa with a knot-like enlargement at the apex of the first vein; terminal section of fourth vein gently bent at middle; posterior margin without folds or sinuses, the basal angle but feebly developed. Halteres, calypters, and their cilia entirely yellow. Length, 4 mm.

Female. Similar to the male, with the usual sexual variations; front coxae somewhat blackened externally at base; middle basitarsi without a bristle above.

Holotype.—Male; Pingree Park, Colorado; July 9, 1938; (James).

Allotype, female; with same data.

Paratopotypes, 3 ♂; Pingree Park; July 9, 1938 and August 19-22, 1935; (M. & H. James).

62. **Dolichopus scopifer** new species

The male runs to *nigricoxa,* couplet 187 of Van Duzee and Curran's key, and the female also runs to this species in couplet 167. The two can readily be separated in the male sex by the yellow cilia of the hind femora (black in *nigricoxa*). Van Duzee's description would also indicate that *nigricoxa* has a broader face and less pollinose thorax. The two species must be very closely related. I can not separate the females.

Male. A rather slender species. Head bright green; front with bronze reflection; face moderately narrow, densely yellowish pollinose; infra-orbital bristles yellow, seven or eight above black; proboscis blackish; palpi yellow. Antennae black; the third segment rounded apically, the arista inserted at about the middle of the dorsal surface. Thorax green, with bronze reflections, rather heavily dusted with white pollen, especially dorsally. Abdomen green, with bronze reflections, and uniformly but lightly white-pollinose, except along the mid dorsal line. Genitalia black; their lamellae of ordinary size, oval, deeply jagged at apex above, yellowish with a broad black apex, fringed with black hairs, except for a few yellow ones above at the base. Coxae black, only the extreme apices yellow, their pollen as on pleura; femora yellow; the middle ones each with one, the hind ones without, preapical bristles; the posterior femora at the middle with a prominent tuft of yellow, almost golden, closely-set cilia, which is conspicuous but considerably shorter than the width of the broadened femora. Tibiae yellow, the hind ones blackened on the apical two-fifths; front tarsi yellow, the fifth segment only black; middle basitarsi yellow, the other segments brownish, becoming black at the apex of the tarsus; hind tarsi wholly black, slightly thickened basally. Ratio of segments of front tarsus 25:16:12:5:7; the fourth segment slightly flattened apically; the fifth triangular, its greatest width five-sevenths its length. Costa with an elongated thickening at the end of the first vein; last section of fourth vein bent gently just before the middle; wing moderately elongated, with a regular, evenly rounded posterior margin, without lobes or sinuses. Halteres and calypters yellow, cilia of calypters black. Length, 5 mm.

Female. Similar to male with the usual sexual differences; face whitish pollinose; front tarsi gradually becoming blackish from the base of the third segment, the last segment somewhat flattened; middle basitarsus with a prominent bristle above just beyond the middle.

Holotype.—Male; Lindland, Colorado; July 27, 1938; (James). *Allotype*, female; *paratopotypes*, 10 ♂, 6 ♀; with same data.

63. **Dolichopus leucacra** new species

The male traces in the Van Duzee and Curran key to *remus*, couplet 17; the female, to *remus*, couplet 93. The purplish front will distinguish it from that species in both sexes; the male may further be distinguished by the white apex of the middle tarsi, the apical thickening of the first two tarsal segments (Dr. Cole's figure of the middle tarsus of *remus* otherwise shows quite well the condition in this species except that the proportion of the segments is somewhat different), the shorter third antennal segment, the yellowish genital lamellae, etc. This species is probably closest to *bisetosus*, but the longer third antennal segment and modified middle basitarsi will readily distinguish the male, and the yellow middle femora, the female.

Male. Face of moderate width, densely silvery pollinose, somewhat yellowish above; front shining green with purplish reflections; infra-orbital bristles wholly black; proboscis and palpi blackish. Antennae wholly black, the first and second segments velvety; third segment large, twice as long as wide, acutely pointed apically; the arista inserted subapically, short and thick, no longer than the second and third antennal segments combined, bare. Thorax shining green, with coppery reflections dorsally; dorsum with almost invisible whitish pollen, pleura lightly but distinctly white pollinose. Abdomen green with coppery reflections; genitalia black, the lamellae small, triangular, but with broadly rounded corners, uniformly yellowish brown, not at all jagged, fringed with fine brown hairs. All coxae black, with broad yellow apices; front femora black, with broad yellow apices; middle femora yellow, though blackened at the base; hind femora black, with extreme apices yellow; middle and hind femora each with two preapical bristles set close together, one slightly above and apicad of the other; hind femora flattened, not fringed with cilia. The ratio of tibiae and five tarsal segments: front, 30:14:6:4:3:4; middle, 46:25:15:15:7:7; hind, 46:24:22:15:9:6. Tibiae yellow, the hind ones black apically; front tarsi yellow, unmodified; middle ones black beyond apex of first segment, (except that the apical half of the fifth is white) elongated, the first three segments enlarged apically, the fourth and fifth narrowly flattened; hind tarsi wholly black. Wings rather narrow, hyaline, with an elongated knot at the apex of the first vein; last section of fourth vein gently bent at two-fifths its length; hind margin indented at the apex of the fifth and with a very slight sinus at the apex of the sixth vein. Halteres and calypters whitish, cilia of calypters black. Length, 5 mm.

Female Similar to the male; face wholly silvery; middle tarsi unmodified and without the white tip; their basitarsi without bristles above; wings broader, brownish, especially near the costa.

Holotype.—Male; Pingree Park, Colorado; July 11, 1937; (James).

Allotype, female; with same data.

Paratopotype, ♂, Pingree Park, July 9, 1938, (James).

COSTA RICAN MYCETOPHILIDAE

(DIPTERA)

BY ELIZABETH G. FISHER

Research Associate in the Department of Insects of The Academy of Natural Sciences of Philadelphia

(Plate XIII)

A collection of Diptera from the Republic of Costa Rica, secured by this Academy, made by Heinrich Schmidt contained the Mycetophilidae (exclusive of the Sciarinae) listed below.

The collection was made in 1930 at San José. San José is in the central plateau of the country, 3,868 feet above sea-level, and the center of a rich agricultural region. The rainy season is generally from April or May to December. The mean temperature is about 68° F.[1]

Two species of Mycetophilidae have been described from Costa Rica, *Ceroplatus minimax* Edwards and *Zygomyia aurantiacea* Edwards. Neither of these was represented in the Schmidt collection.

Three species in this collection apparently represent forms hitherto recorded only from Nearctica. There are three extensions in range of Neotropical species. Two new subspecies and ten new species are described.

Macrocera unica new species (Pl. XIII, figs. 1 and 2.)

This species resembles *Macrocera nobilis* Edwards in wing markings, and *M. valdiviana* Philippi in coloration except the median mesonotal stripe is not " T "-shaped.

Male. Total length 5 mm.; wing length 4.5 mm. Head brownish; ocelli surrounded by an area of black. Head furrows deep. Antennae yellow; scape slightly brownish. Prothorax yellow. Mesonotum yellow with three wide brown stripes; the median stripe abbreviated behind, not reaching the scutellum; the lateral stripes curving towards the lateral margins of the mesonotum anteriorly, reaching posteriorly to the scutellum, and giving off lateral branches to the wing bases. Scutellum yellow. Pleura brown, yellow below the wing bases. Legs yellow, distal ends of the meso- and metacoxae brown; tips of the fore tibiae suddenly widened with an apical comb (see fig. 2). Wings as figured (fig. 1). Halteres yellow. Abdomen yellow; distal half of second and third abdominal tergites dusky; sixth to eighth tergites dusky. Styles simple with two teeth as in *M. geminata* Johannsen.

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[1] Encyclopaedia Britannica, 14th Edition, Articles on San José and Costa Rica.

Holotype.—♂; San José, Costa Rica; November 2, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia, Type no. 6561].

Platyura (Proceroplatus) pictipennis Williston (Pl. XIII, fig. 6.)

1896. *Platyura pictipennis* Williston, Trans. Ent. Soc. London, 1896, p. 257; pl. 8, f. 10.

1925. *Platyura (Proceroplatus) pictipennis* Edwards, Trans. Ent. Soc. London, 1924, p. 523.

San José, Costa Rica; IV 5, VI 27, 1930; (H. Schmidt); 4 ♂.

The wing band in cell R_5 is wider than in Williston's figure. Abdominal tergites II–VI are dark basally and pale apically as in Williston's specimen.

They differ from Nearctic specimens of *P. elegans* Coquillet in not having abdominal segment V entirely yellow and in the structure of the male terminalium (fig. 6).

The antennae are shorter than in *P. catharinae* Edwards, there is a yellow line along the center of the mesonotum, and a hyaline spot at the tip of cell R_5.

Platyura (Lyprauta) chacoensis Edwards?

1931. *Platyura (Lyprauta) chacoensis* Edwards, Konowia, x, p. 77.

San José, Costa Rica; IV 29, IX 14, 1930; (H. Schmidt); 3 ♂.

These specimens agree with Edward's description except in the color of the mesonotum. The mesonotum is as described for *P. (L.) defecta* Edwards, but the brown cloud is at the wing tip. The halteres are entirely yellow.

Mycomyia tantilla Loew

1869. [*Sciophila*] *tantilla* Loew, Berl. Ent. Zeit., XIII, p. 140.

San José, Costa Rica; V 5–VI 19, 1930; (H. Schmidt); 2 ♂.

This species has only been recorded hitherto from Nearctica.

Monoclona abnormalis new species

These specimens possess vein Cu_1 at the wing margin; the macrotrichia are reflexed; Sc_2 ends in R_1 almost at the base of R_s; and they lack anepisternal setae. I consider them to as members of the genus *Monoclona* which have retained a short remanent of vein Cu_1.

This species differs from *Monoclona maculata* Edwards and *M. bicolor* (Enderlein)[2] and *Acnemia binocellaris* Edwards in the possession of a median ocellus. It lacks the wing markings of *A. fulvicollis* (Philippi).

Male. Total length 3 mm. Head brown. Palpi black. Antennae brown, yellow basally; flagellar pubescence white. Ocelli three, in a straight line; each ocellus surrounded by a narrow ring of black. Thorax yellow; mesonotum dusky with indications of dark stripes at the acrostical and dorsocentral rows. Anepisternites and pteropleurites bare; pleurotergites and postnotum setose; scutellum with four strong setae and several smaller setae. Legs yellow. Wings hyaline; C extends beyond tip of R_5; Sc_2 ends at or just beyond the base of R_s; R_4 present; stem of M little longer than r-m; Cu_1 an incomplete vein at the wing margin; anal strong. Halteres yellow. Abdomen deep brown with indications of basal yellow triangles on the tergites. Male terminalium yellow.

Holotype.—♂ ; San José, Costa Rica; August 21, 1930; (H. Schmidt); [Academy of Natural Sciences, Philadelphia. Type no. 6562].

Paratype.—1 ♂ ; San José, Costa Rica; I 4, 1930; (H. Schmidt).

Dziedzickia nigra new species

This species differs from *D. pubercornis* Edwards in the shorter antennae, the long Sc, the presence of macrotrichia on veins M and Cu, and the yellow first abdominal segment. It differs from *D. fiebrigi* Edwards in color, in the shorter stem of M, and in the position of the Cu fork.

Male. Total length 3 mm. Head black, shining; palpi and bases of antennae brownish. Thorax black; membrane surrounding the anterior spiracles and the wing bases, the halteres, and the hypoleurites yellow. Mesonotal disk bare except for biserial dorsocentral and acrostical hairs.

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[2] =*Acnemia bicolor* End. + *A. vittidorsum* End. according to Edwards (Rev. Ent., Rio de Janeiro, IV, p. 363, 1934) who has examined the types.

Pleurotergites bare.[3] Legs yellow; trochanters blackish. Wings hyaline; Sc ends in R at half the distance from the humeral cross-vein to the base of R_s, R_4 absent; stalk of M slightly longer than r-m. Cu forks under the proximal end of the r-m cross-vein. Halteres yellow. Abdomen black except the first and most of the fourth tergites, the posterior margins of the second and third tergites, and the venter of first to fifth tergites which are yellow.

Holotype.—♂; San José, Costa Rica; June 14, 1930; (H. Schmidt). [Academy of Natural Sciences of Philadelphia. Type no. 6563].

Paratype.—1 ♂; same data; VII 1, 1930.

Leia schmidti new species (Pl. XIII, fig. 4.)

This species is very similar in coloration to the Nearctic species, *Leia bivittata* Say; the abdominal fasciae are not emarginate as is often the case with *L. bivittata* Say; the wings often lack the preapical fascia; the postnotum is rarely black or brown, usually yellow; the male terminalium differs. In Enderlein's key[4] the hyaline-winged forms run to *L. axillipunctum* Enderlein but veins M_3 and Cu_1 are complete to the wing margin; the fasciate-winged forms run to couplet 15 but differ in abdominal color. Edwards' species[5] all lack the large black mesonotal spots at the wing bases.

Male. Total length 4 mm. Head yellow, somewhat brownish between the ocelli; the three ocelli immediately surrounded by black. Antennae black except the scape and the undersides of the three basal flagellar joints. Thorax yellow with two large black spots at the wing bases which extend on the mesonotum from the scutellum anteriorly to the rudiments of the transverse suture, separated medially by yellow, and extend over the pteropleurites, pleurotergites, and hypopleurites; scutellum yellow with two strong scutellar setae; postnotum black to yellow. Wings hyaline or with preapical fascia; M_3 and Cu_1 reach the wing margin; Cu_1 narrowly detached at its base. Halteres yellow. Fore tibiae with a small sub-basal seta on the flexor surface; middle tibiae with four setae on the flexor surface. Legs yellow, tips of coxae, trochanters, and hind femora with black spots. Abdomen largely black with narrow yellow bases on segments

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[3] The absence of pleurotergal hairs I have not considered of generic importance, as this species is so similar in other respects to those species possessing pleurotergal setae.

[4] Stett. Ent. Zeit., LXXII, 187, 1911.

[5] Rev. Ent., Rio de Janeiro, III, pp. 311-319. 1933.

one to six, seventh and eighth segments yellow; the rudimentary eighth segment with short setae. Terminalium black, anal lobes yellow (fig. 4).

Female. Similar to the male. In three specimens there is an indication of a median stripe, but they are otherwise apparently identical.

Holotype.—♂ ; San José, Costa Rica; September 7, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6564].

Allotype.—♀ ; San José, Costa Rica; VIII 3, 1930; (H. Schmidt).

Paratypes.—20 ♂ ; 13 ♀ ; San José, Costa Rica; IV–IX 16, 1930; (H. Schmidt).

Leia bipunctata new species (Pl. XIII, fig. 5.)

This species is similar to *Leia schmidti* differing in having the black mesonotal spot above the wing base divided into two spots by a transverse yellow line; the hind femora with apex blackish, especially below; scutellum with four setae; postnotum yellow with its lateral portions black; vein M_3 bent toward M_{1+2} near the wing margin. Terminalium roughly similar to *L. schmidti* but the styles are more boot-shaped, the median ventral lobe is more rounded at the tip (fig. 5).

Holotype.—♂ ; San José, Costa Rica; July 7, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia, Type no. 6565].

Allotype.—♀ ; San José, Costa Rica; VI 11, 1930; (H. Schmidt).

Paratypes.—2 ♂ ; same data; April and VI 11, 1930; (H. Schmidt).

Leia oblectabilis (Loew)

1869. [*Glaphyroptera*] *oblectabilis* Loew, Berlin Ent. Zeit., XIII, p. 146.

Eighty-three specimens from San José taken from June through September apparently do not differ from Nearctic specimens.

Leia circumfera new species

This species runs to *L. picticornis* Kertéz in Enderlein's key,[4] but the center of the scutellum and the head are black in this species. This species is close to *L. diversipes* Edwards, the front tibiae possess a stout sub-basal seta on the flexor surface; the color of the legs differ; the wings are hyaline; the stem of M is longer; the halteres are yellow. This species differs from *L. monoleuca* Edwards in lacking the terminal white antennal segment and in leg coloration.

Female. Total length 4 mm. Head black, face and palpi brown; scape yellow, flagellum brown. Thorax black, shining except humeral angles of the mesonotum, lateral portions of the scutellum, the membranes surrounding the anterior spiracles and the wing bases yellow. Pronotum brownish, yellow ventrally. Scutellum with two strong setae. Wings hyaline, stalk of M $\frac{1}{3}$ as long as r-m; M_3 and Cu_1 do not reach the wing margin; Cu_1 narrowly broken at its base. Halteres yellow. Legs yellow; hind coxae dusky at the base, trochanters dusky, middle and hind femora with black edges all around their circumference in lateral aspect. Abdomen black, yellowish below at its base. The paratype has basal yellow bands on the second to fifth abdominal segments but is otherwise similar.

Holotype.—♀; San José, Costa Rica; June 20, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6566].

Paratype.—♀; Same data; June 19.

Leia analis new species (Pl. XIII, fig. 3.)

This species runs to *L. truncatovenosa* Enderlein and *L. axillipunctum* Enderlein in Enderlein's key but differs from the former in the slight break at the base of Cu_1; Cu_2 is complete, the tibiae of all but one individual lack the brown spots below and the scutellum is yellow. It differs from the latter in having the wing spot small, Cu_2 not straight beyond the prominent bend but bent anteriorly at its tip. It differs from the " completa group " in having M and Cu_1 not reaching the wing margin; it resembles the " incompleta group ", but lacks the apical wing-band, the fore tibiae have a stout bristle on their flexor surfaces; there are only two scutellar setae.

Male. Total length 3.2 mm. Head yellow; three ocelli surrounded by black. Antennae and palpi yellow. Thorax yellow; mesonotum with minute black spot above the wing bases; pleura yellow; scutellum yellow with two strong scutellar setae; postnotum yellow. Wings hyaline; M_3 and Cu_1 do not continue to the wing margin; Cu_1 narrowly detached at its base. Halteres yellowish-white. Legs yellow, fore tibiae with a strong black subbasal setae on the flexor surface. Abdominal tergites one through four yellow with wide brown posterior margins, tergites five and six dark brown with yellow posterior margins, tergites seven and eight yellow, terminalium yellow (fig. 3).

Female. Similar to male in size, leg structure, wing venation, and color except the abdomen which is almost uniformly brown.

Holotype.— ♂ ; San José, Costa Rica; September 7, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6567].

Allotype.— ♀ ; San José, Costa Rica; IX 5, 1930; (H. Schmidt).

Paratypes.—6 ♂ , 3 ♀ ; San José, Costa Rica; V 5, 1930, VII 20-29, 1930, IV 2-10, 1930; (H. Schmidt).

One male differs strikingly in coloration but not in structure from the type and other paratypes. The abdomen is similar to that of the female; top of head brown; mesonotum with three stripes; pleura especially pleurotergites brown; postnotum brown.

Leia bivittata tropicalis new subspecies

This species belongs to the " fasciata group " having the second antennal segment with a seta and the rudimentary eighth segment of the male with a row of setae. It lacks the wing spot and band of *L. falculata* Edwards and the anepisternites and pleurotergites are not black. *L. fasciata* (Kertéz) differs in the black anepisternite. This subspecies differs from *L. halterata* (Kertéz) in the larger spot over the wing bases, legs without brown marks, no wing bands or spots, halteres entirely yellow. I consider these specimens as subspecies of *L. bivittata* Say.

This species is similar to *L. bivittata* Say but the lateral spots on the mesonotum are large, oval, shining black, but not connected posteriorly with a broad black pleural area, the pleura being entirely yellow. Scutellum with four strong setae. Postnotum yellow. Legs yellow. Wings hyaline, venation as figured by Johannsen for *L. bivittata* Say.[5] The terminalium is identical in form except in the form of the tips of the supra-anal lobes (median ventral process of Johannsen, fig. 98 l.c.). Abdomen yellow with black posterior margins to the tergites.

Holotype.— ♂ ; San José, Costa Rica; September 10, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6568].

Allotype.— ♀ ; Same data; VII 15, 1930.

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[5] Maine Agr. Exp. Sta., Bull. 196, fig. 207, 1911.

Leia bivittata punctiformis new subspecies

Differs from the above subspecies only in having the mesonotal spots minute.

Holotype.—♂; San José, Costa Rica; June 28, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6569].

Paratype.—1 ♂; same data; VII 16, 1930.

Leiella bicolor new species

This species is apparently very similar to the genotype, *L. ochreocalcar* End., but the lateral margins of the mesonotum are broadly yellow and the first and fourth abdominal segments are yellow. The wing fascia is at the distal end of the wing as in the specimens of *L. ochreocalcar* noted by Edwards in the Dresden and Vienna Museums.

Male. Total length 4 mm. Head black above, yellow below the ocelli. Antennae with scape and basal flagellar joints yellow, flagellum darkened distally Prothorax yellow, pronotum with a long, strong seta at its cephalo-dorsal angle. Mesonotum black with wide yellow lateral margins. Scutellum black with 4 strong marginal setae. Postnotum black. Membrane surrounding the anterior thoracic spiracle yellow. Anepisternites, sternopleurites, pteropleurites and pleurotergites black. Anepisternites and sternopleurites longer than broad. Wings with a brown spot in base of cell Sc, distal third of wing brown, deeper towards the costal margin. Base of R_s present. M_{1+2} and Cu_1 detached at their bases. Halteres yellow. Coxae yellow; trochanters black; fore femora darkened at their bases, middle and hind femora black, each side with a lateral, oval, yellow spot. Abdomen black, tergites one and four yellow, venter of one to four yellow. Terminalium black.

Holotype.—♂; San José, Costa Rica; August 22, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6570].

Novakia distincta new species

This is the first Neotropical species to be referred to this genus. Three ocelli with the laterals removed from the eye margins by about twice the diameter of the ocellus; the short Sc ending free, the very short R_1, the nearly horizontal r-m which is twice as long as R_1 seems to place this species in *Novakia*.

Male. Total length 1.8 mm. Head black, palpi yellow; antennae black, scape brown. Second joint of scape with a long dorsal seta. Ocelli three; the laterals removed from the eye margins by about twice the diameter of an ocellus. Thorax black; scutellum with four marginal setae, the median pair longer. Mesonotal and scutellar setae yellowish. Legs yellow; middle and hind coxae blackish at base; middle femora below and hind femora black; hind tibiae blackish. Middle femora with a sensitive area on their extensor surfaces above which the femora are slightly swollen. Wings hyaline; C extends beyond R_8 three-fifths of the distance to M_{1+2}; Sc short, ending free; R_1 very short; one-half as long as r-m which is longitudinal in position; M forks under the base of R_8; Cu forks proximad of M fork; Anal vein fine but distinctly setose, ends at the level of the Cu fork. Halteres yellow, abdomen black including terminalium. Seventh segment retracted.

Female. Similar to male.

Holotype.—♂; San José, Costa Rica; September 2, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia, Type no. 6571].

Allotype.—♀; same data; IX 10, 1930.

Paratypes.—6 ♂, same data; IX 5-19, 1930; (H. Schmidt).

Allodia callida Johannsen

1911. *Allodia callida* Johannsen, Maine, Agr. Exp. Sta., Bull. No. 196, p. 319, fig 135.

San José, Costa Rica; IX 7 and 13, 1930; (H. Schmidt); 2 ♂.

There is but one other species described as belonging to this genus in the Neotropical region, *Allodia brevicornis* Enderlein, Edwards[6] suggests that the latter belongs to *Neallodia.*

These specimens have the costa ending at the tip of R_5; they are identical with specimens from New York.

Sceptonia ornatifemora new species (Pl. XIII, figs. 7 and 8.)

There is only one described Neotropical species in this genus, *S. longicornis* Enderlein. This species differs from Enderlein's southern Brazilian one in size only, according to Enderlein's description which gives mostly characters of generic rank. Because of the difference in range and size I consider these two forms as distinct species.

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[6] Rev. Ent., Rio de Janeiro, II, p. 147, 1932.

Male. Total length 2.3 mm. Head black shining, antennal bases yellow. Thorax black, wing bases and halteres yellow. Legs yellow; extreme bases of hind coxae blackish, hind femora with their apical halves black. Fore tibia slightly longer than fore basitarsus, middle tibia with one seta below. Abdomen black, terminalium yellow and somewhat similar to *S. subnigra* Fisher (= *S. nigra* Mg) as figured by Johannsen[7] nec *S. nigra* Mg. of Edwards,[8] but differs in the form of the styles (figs. 7 & 8).

Female. Similar to the male.

Holotype.—♂; San José, Costa Rica; August 4, 1930; (H. Schmidt); [Academy of Natural Sciences of Philadelphia. Type no. 6572].

Delopsis planiventris (Enderlein)

1911. *Plastocephala planiventris* Enderlein, Stett. Ent. Zeit., LXXII, pp. 176-178.

San José, Costa Rica; V 15, 1930; (H. Schmidt); 1 ♀.

I believe this species is Enderlein's *Plastacephala planiventris*. If so, *Plastacephala* is a synonym of *Delopsis* as was suggested by Edwards.[9]

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[7] Maine Agr. Exp. Sta., Bull. 200; fig. 96, 1912.

[8] Trans. Ent. Soc. London, 1924: pl. 57, figs. 158, 159.

[9] Rev. Ent., Rio de Janeiro, II, p. 148, 1932.

EXPLANATION OF PLATE XIII

Fig. 1.—*Macrocera unica*—wing.

Fig. 2.—*Macrocera unica*—tip of fore tibia.

Fig. 3.—*Leia analis*—lateral aspect of male terminalium.

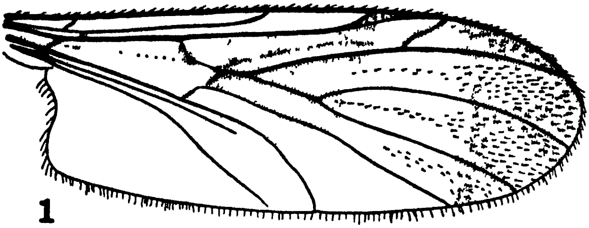
Fig. 4.—*Leia schmidti*—dorsal aspect of male terminalium.

Fig. 5.—*Leia bipunctata*—dorsal aspect of male terminalium.

Fig. 6.—*Platyura pictipennis*—ventral aspect of left style.

Fig. 7.—*Sceptonia ornatifemora*—dorsal aspect of right style.

Fig. 8.—*Sceptonia ornatifemora*—lateral aspect of style, dorsal to the left.



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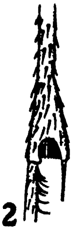

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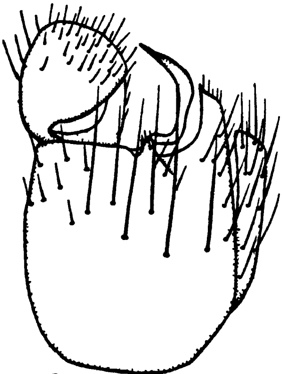

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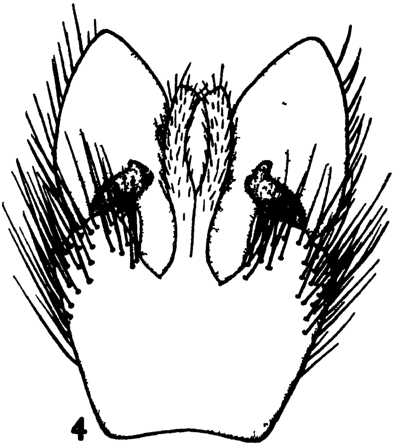

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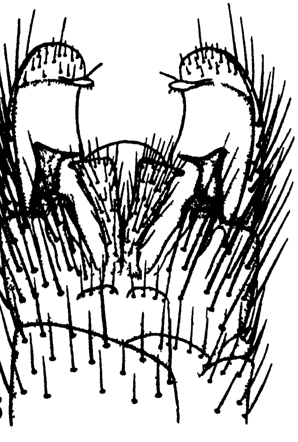

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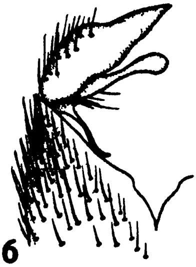

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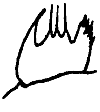

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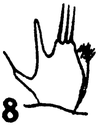

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FISHER—MYCETOPHILIDAE

STUDIES IN NORTH AMERICAN MANTISPIDAE

(NEUROPTERA)

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(Plate XIV and text-figures)

This interesting and relatively little known family of the Neuroptera has not attracted the attention of many workers in recent years. Our knowledge of the North American forms is due in a large measure to the studies of Banks, who described many of our native species and who, in 1912,[1] published a key to the North American genera.

The only comprehensive classification of this family is that of Enderlein's [2] which is practically a generic synopsis of the group. Since this time a great many forms have been described from all parts of the world, in the numerous papers of Navas, and some of the genera that he erected are now known from the United States.

The character of many of the existing descriptions as well as the limited amount of material that has been assembled leads the present writer to believe that it would not be wise to attempt a comprehensive revision of all of the North American members of the group, at present. Therefore, the present set of studies has been inaugurated to bring together such material as is reasonably complete and comprehensive and as a result believed worthy of publication.

The writer is indebted to the following persons and institutions who have contributed material, cooperation and valuable suggestions: Mr. Nathan Banks of the Museum of Comparative Zoölogy, Mr. A. B. Gurney of the United States National Museum, Dr. Van Dyke of the California Academy of Sciences,

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[1] Proc. Ent. Soc. Washington, XIV, p. 178.

[2] Stett. Ent. Zeit., LXXI, pp. 341-379, (1910).

Mr. W. T. Davis, the Illinois State Natural History Survey and the American Museum of Natural History.

A number of genera of Mantispidae have already been recorded from the United States and a few previously unrecorded genera are represented in collections now before the author. Although the work on the material of all of these genera has not been finished I believe that a key to all of the genera known from the United States will be of some use to other workers.

Key to the North American Genera

1. Anterior tarsi with two terminal claws; pronotum not greatly elongate (Platymantispinae) 2

   Anterior tarsi with only one terminal claw; pronotum greatly elongate (Mantispinae) 4

2. Anterior tibiae prolonged into a digitiform process, tarsi arising from tibiae before digitiform process; anterior tarsi with four segments; anterior femora below with small dentations (Platymantispini). *Plega* Navas

   Anterior tibiae not prolonged into a digitiform process, tarsi arising from apex of the tibiae; anterior tarsi with five segments; anterior femora below with relatively large tooth-like dentations.................. 3

3. Subcosta joining costa at a little more than one-half the distance to pterostigma; area between radius and the remainder of the radial sector divided into three short, subquadrate cells (Nolimini). *Nolima* Navas

   Subcosta not joining costa but running to pterostigma; area between radius and the remainder of the radial sector divided into three long radial cells (Drepanicini).....................*Drepanicus* Blanchard

4. Radial cells long and narrow, particularly the basal two; pronotum with either strong transverse rugae or sudden and strong constrictions, or both.. 5

   Radial cells not long and narrow, the basal two relatively broad; pronotum without either strong transverse rugae or sudden constrictions.. 6

5. Pronotum with strong transverse rugae and prominent but flattened pronotal tubercles; pterostigma thickened; anterior portion of wing not fuscous. ....*Entanoneura* Enderlein

   Pronotum with sudden and strong constrictions but without strong transverse rugae; pronotal tubercles low and rounded; pterostigma not greatly thickened; anterior portion of wings fuscous. *Climaciella* Enderlein

6. Pronotum with evident transverse rugae, without short, stiff setae. *Mantispa* Illiger

   Pronotum without evident transverse rugae, with short stiff setae. *Mantispilla* Enderlein

PLATYMANTISPINAE [8]

Three genera of this subfamily are found within the boundaries of the United States and each of these is a member of a different tribe.

DREPANICUS Blanchard

1851. *Drepanicus* Blanchard, in Gay, Historia fiscia y politica De Chile, Zoologia, vi, p. 71.
1867. *Drepanicus* Brauer, Verh. zool.-bot. Ges. Wien, xvii, p. 282.
1910. *Drepanicus* Enderlein, Stett. Ent. Zeit., lxxi, pp. 344, 378.

GENOTYPE (by monotypy): *Drepanicus gayi* Blanchard.

The key to genera will separate the one member of this genus from any of the other known North American forms.

Drepanicus prasinus Petersen

1912. *Drepanicus prasinus* Petersen, Ent. Mitt., i, p. 272, fig. 6. [♀; Greenville, Plumas County, California.]

No additional material of the form has been recorded and as the type had lost one front leg and the claws of the other there is some doubt as to its generic position. From a critical examination of the literature involved it seems probable that this species will be found to be generically distinct from *Drepanicus gayi* Blanchard.

The primitive type of venation and the general grass green color will readily separate this from any of the known North American species, the yellowish white face, labium and palpi, as well as the yellow w-shaped figure below the antennae, and the yellow longitudinal stripe on the dorsum of the thorax will further differentiate this interesting species.

This species is known only from the originally described specimen, which was collected at Greenville by Dr. Walther Horn.

PLEGA Navas

1877. *Symphrasis* Hagen, Stett. Ent. Zeit., xxxviii, p. 208. (In part.)
1892. *Symphrasis* Banks, Trans. Amer. Ent. Soc., xix, p. 337.
1910. *Symphrasis* Enderlein, Stett. Ent. Zeit., lxxi, pp. 344, 374. (In part.)
1927. *Plega* Navas, Revista Chilena de Historia Natural, xxxi, p. 326.

GENOTYPE (by original designation): *Symphrasis signata* Hagen [=*Plega signata* (Hagen)].

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[8] For the use of this name see Rehn, *Ent. News*, l, p. 82, (1939).

The complex for which Navas erected the name *Plega* is quite closely related to *Symphrasis* but it appears to be worthy of generic separation. However, as I have not been able to critically study *Symphrasis* as understood by Navas, I am not able to add materially to his original comparison and characterization of *Plega* with this genus.

The present genus is quite similar to *Symphrasis* Hagen but differs from it by lacking incrassate posterior tibiae, and by the wings usually having only a single series of gradate veins, the anterior wing usually have two medio-cubital cross veins and the posterior wing has media anterior (recurrent ramus of the radial sector, or anterior procubitus) present, and is without an internal intermediate vein.

This genus contains a single Mexican form [4] and the four North American species *signata* Hagen, *fratercula, banksi* and *dactylota* with its race *lipanica,* these latter being here described.

In all of the forms of the genus before me there are practically no external characters of sufficient weight to be used for separating the various forms, except in the case of the color pattern, which has been found sufficiently constant to allow its use in separating a geographic race. Even though a considerable amount of time has been spent trying to differentiate the females of the various forms it has been impossible to find any definite characters for their separation.

It has been found advisable to give a rather full description of *signata* and to limit the treatment of the other forms to a discussion of those characters in which they differ or supplement the general description.

Key to the forms of the genus Plega found within the United States, based on the male sex

1. Parameres with three simple, curved, digitiform processes at distal extremity (fig. 2); tenth sternite with median lobe, in lateral aspect, subtruncate to concave posteriorly, distal margin either subtruncate or weakly rounded (fig. 8) .... *signata* (Hagen)

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[4] *Plega variegata* Navas, Revista Chilena de Historia Natural, xxxi, p. 327, [♂, Motzorongo, Mexico], (1927).

This species is separable from the North American forms by having a light collar on the anterior margin of the pronotum and a small posterior transverse bar.

Parameres with more than three digitiform processes; tenth sternite medially either bluntly falcate or lobate with posterior margin in lateral view convex and with distal margin arcuate, with a distinct obtuse angulation, or slightly recurved..............................2

2. Parameres with five digitiform processes, at apex (fig. 4); tenth sternite with median process arcuate, distal margin arcuate and slightly recurved (fig. 7)................................*fratercula* new species

Parameres with more than five digitiform processes; tenth sternite with median process either bluntly falcate or with distal portion arcuate or obtusely angulate but never recurved..............................3

3. Parameres relatively slender distad, with seven closely adpressed digitiform processes which are along the general axis of paramere (fig. 1); tenth sternite with median process bluntly falcate (fig. 6) *banksi* new species

Parameres relatively stout distad, with nine bunched, opposable digitiform processes, which are directed at an angle from the shaft of the paramere (figs 3, 5); tenth sternite with a median lobe.............3

4. Light lateral bars of pronotum usually not broken, except at anterior constriction, extending at least one-half the length of pronotum; passing into posterior light portion; head with supra-antennal spots either connected with light line along inner margin of eye, or this line produced toward supra-antennal spot; median lobe of tenth sternite with distal margin rounded (fig. 9)....*dactylota dactylota* new species

Light lateral bars of pronotum broken behind anterior constriction, never extending more than one-fourth the length of pronotum; postero-lateral portions of pronotum light; head with supra-antennal spots distinct from light line along inner margin of eye, this line rarely produced toward supra-antennal spots; median lobe of tenth sternite obtuse angulate distad (fig. 10) *dactylota lipanica* new subspecies

Plega signata (Hagen) (Figs. 2, 8.)

1877. *Symphrasis signata* Hagen, Stett. Ent. Zeit., xxxviii, p. 208. [♀, Fort Tejon, California.]

1892. *Symphrasis signata* Banks, Trans. Amer. Ent. Soc., xix, p. 358.

1907. *Symphrasis signata* Banks, Cat. Neuropt. Ins. U S., p. 23.

1910. *Symphrasis signata* Enderlein, Stett. Ent. Zeit., lxxi, p. 374.

1912. *Symphrasis signata* Banks, Proc. Ent. Soc. Washington, xiv, p. 178.

1927. *Plega signata* Navas, Revista Chilena de Historia Natural, xxxi, p. 326.

The variation in pattern in the present form is so great that the only satisfactory means of distinguishing *signata* from the related forms is by an examination of the internal genitalia of the male. The parameres of this form are very distinctive as their apex is supplied with three relatively slender and curved digitiform processes of which the median one is longest, while in all the related forms there are more than three processes distad on the parameres. The median process of the tenth sternite is lobate as in *dactylota* and its race and not bluntly falcate as in *banksi,* nor recurved apically as in *fratercula,* moreover, the process, in lateral aspect, is subtruncate to concave posteriorly instead of being rounded as in *dactylota* and the distal margin of this process is either subtruncate or weakly rounded never broadly arcuate or with an obtuse angulation.

Hagen's type of this form has been examined,[5] and material has been compared with it, but as it is a female the genitalia have not been examined. The following general description of this species has been drawn from the material at hand.

Male. Actual size relatively variable but generally about average for genus; general form moderately elongate and only relatively broad; general color light, tilleul-buff to fuscous, with a dark pattern, dark fuscous to black, over most of body.

Head large, subcircular, greatest width approximately equal to greatest height; eyes large, their height equal to slightly more than one-half that of whole head, outer margins evenly and broadly convex, inner margins subparallel, flattened; antennae situated high, about middle of face, distance between them about twice that between them and nearest eye margin; antennal joints numerous, always more than forty, segments submoniliform with a ring of setae near apex; clypeus transversely trapezoidal about twice as broad as long; labrum subquadrate, rounded apically; vertex highly and evenly arched; in lateral view, eyes very prominent, extending forward of rest of head; temples narrow and strap-like.

Prothorax relatively short and broad; pronotum with greatest length about one and one-third times the greatest width, which is at proximal third, anterior margin evenly arcuate; lateral margins evenly and gradually convergent to the posterior margin, which is truncate, where the width between them is equal to two-thirds the greatest width of the pronotum: posterior third of pronotum fused along mid-ventral line, lateral margins of anterior two-thirds widely separated and covering only the dorsum and upper portions of the propleura; dorsal surface with from two to four weak transverse sulci, dorsum with long, black setae: prosternum small

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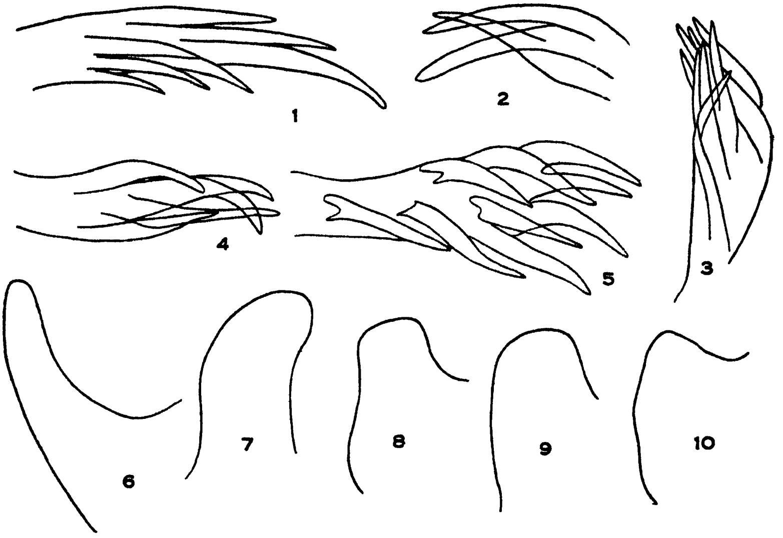
[5] The type, which has the wings quite badly broken, is in the Museum of Comparative Zoölogy and bears the following labels: Ft. Tejon, Cal., (T. Brown, 1879). Type #10429.



EXPLANATION OF FIGURES 1 TO 10

Fig. 1.—*Plega banksi* new species. Apex of paramere (type). Kits Peak Rincon (Greatly enlarged.)

Fig. 2.—*Plega signata* Hagen. Apex of paramere. Boulder Springs. (Greatly enlarged.)

Fig. 3.—*Plega dactylota dactylota* new species. Apex of paramere. (paratype). Prescott. (Greatly enlarged.)

Fig. 4.—*Plega fratercula* new species. Apex of paramere. (type). Capitan Mt. (Greatly enlarged.)

Fig. 5.—*Plega dactylota dactylota* new species. Apex of paramere, expanded. (paratype). Prescott. (Greatly enlarged.)

Fig. 6.—*Plega banksi* new species. Lobe of tenth sternite. (type). Kits Peak Rincon. (Greatly enlarged.)

Fig. 7.—*Plega fratercula* new species. Lobe of tenth sternite. (type). Capitan Mt. (Greatly enlarged.)

Fig. 8.—*Plega signata* Hagen. Lobe of tenth sternite. Oroville. (Greatly enlarged.)

Fig. 9.—*Plega dactylota dactylota* new species. Lobe of tenth sternite (paratype). Kingman. (Greatly enlarged.)

Fig. 10.—*Plega dactylota lipanica* new subspecies. Lobe of tenth sternite. (paratype). Hills west of Ord Mts. (Greatly enlarged.)

but evident between anterior coxae; proepisternum very small, trigonal; proepimeron relatively prominent, subrectangulate, slightly longer than broad.

Meso- and metathorax as in all the other members of this family. Anterior wings rather short and broad, their greatest length being slightly less than two and one-half times their greatest width; more than a dozen costal veinlets, two long subcostal cells which extend from the wing base to the pterostigma, two long rather narrow radial cells extending from the base of the second subcostal cell to the apex of the pterostigma, from these cells there are usually seven or eight radial sectors, three or four from the first cell and the remainder from the second, usually seven gradate cross-veins, the last of which connects the two branches of media and the next to last connects the radial sector with media, cross-vein r-m present and cutting off a small almost trigonal cell, medio-cubital cross-vein and two accessory cross-veins present, one of these being the last gradate cross-vein, cubitus branching near the base, Cu2 starting at a right angle to the main vein, cubital cross-vein present, first anal present and not branching until almost at wing margin, connected with second anal near base by a cross-vein, second and third anals rising together but separating about half way to the wing margin, arcuate and cardinal veins present but small and unbranched; wing deeply notched basad of arcuate vein; pterostigma long and narrow, veins within it discernible, its base and apex dark but with a light band mesad; wing clouded at apex, near margins and at some of the branches with fuscous, remainder light; veins alternating light and fuscous. Posterior wing shorter and narrower than anterior but its proportions practically the same; costal region narrow and soon becoming obsolete, approximately half a dozen costal veinlets, one long subcostal cell extending from the base of the wing to the pterostigma, two long narrow radial cells which extend nearly the entire length of the wing, usually five radial sectors and six gradate cross-veins, the last connecting median and cubitus, next to last connecting the radial sector with media, media anterior present, short and joining the radial sector at the base of the first radial cell, media with two simple branches, cubitus branching much as media in anterior wing, first anal simple, second and third anals coalescent, rest of wing as in anterior one. All veins and wing margins with numerous short, erect setae.

Abdomen, except for apex, as usual for group; supra-anal plate broadly bilobate, these lobes which are broadest ventrad, are twice as long as broad, subgenital plate small subtrigonal, apex obtuse, with a medio-longitudinal carina. Genitalia, for general structure of phallus (see figure 15); of parameres and tenth sternite (see figure 21); parameres quite long and slender, somewhat tapered, apex with three relatively slender, curved digitiform process, median one longest (see figure 2); median lobe of tenth sternite, in lateral aspect, relatively large, greatest length equal to approximately three times distal width, posterior margin shallowly concave, occasional almost subtruncate, distal margin usually weakly rounded, rarely almost subtruncate (see figure 8).

Anterior coxae elongate, subcylindrical, six times as long as broad, with scattered erect setae; anterior trochanter subtrigonal, greatest width equal to two-thirds greatest length, armament as on anterior coxae; anterior femora inflated, subrectangulate, greatest width, which is at proximal third equal to slightly less than one-third total length, dorsal margin weakly sigmoid, ventral rounded convex with scattered small tubercles interspaced by an occasional larger one; external and internal surfaces convex, setae of the same character as those on coxae but not as dark, internally with a row of very strong setae near ventral margin and near base a rather small but prominent spine with its dark base but apex light. Anterior tibiae three-fourths as long as anterior femora, arched to fit ventral margin of femora, more or less cylindrical but slightly narrower at apex than at base. Anterior tarsi with basal article elongate, longer than remainder of tarsus, apex an elongate spine-like tubercle; second article attached to metatarsus in basal half, elongate, subcylindrical, five or more times as long as broad; third article small, subquadrate; last article elongate, greatest length equal to twice greatest width which is at apex, apex with a pair of long curved claws and a prominent median puvillus.

Median femora elongate, cylindrical, more than five times as long as broad, with numerous setae of the usual character. Median tibiae elongate cylindrical, one-third longer than femora, apex with a pair of tibial spurs, setae as usual. Tarsi, four basal articles with two pads of strong, closely-set setae on ventro-apical margin; metatarsus elongate, as long as rest of tarsus; second article twice as long as broad; third and fourth subquadrate; ultimate article slightly longer than broad with a pair of long curved claws and a large median puvillus.

Posterior femora elongate, cylindrical, approximately one-third longer than median femora, setae as usual. Posterior tibiae slightly more than twice as long as median femora, apical spurs present. Tarsi the same as those of median limb.

Female. Essentially the same as male except for the apex of abdomen which has a long, very thin, blade-like ovipositor which is equal to two-thirds the abdominal length, slightly wider near base but its sigmoid margins subparallel for most of their length, apex broadly and evenly rounded.

Pattern. General color light with a dark pattern: head with the following light areas, lateral and apical margins of clypeus and labrum; a narrow inter-antennal, longitudinal bar; a pair of supra-antennal spots which are either produced toward or connected laterally with the light line along inner margin of eye or this line is produced mesad toward these spots: vertex medio-anteriorly, with a rather large subtrigonal or subovate spot, laterad of which, on each side, and separated from median spot by a long irregular dark band, are light posteriorly convergent stripes, latero-posteriorly immediately following this a narrow oblique black band. remainder of vertex to and including posterior margin light. Pronotum with a light pattern, however at times entirely dark, as follows: posterior third or half usually rather light, two light dorso-lateral bands extending at least one-half the length of pronotum and passing into light posterior portion, usually a trace of a light median band; lower surface light. Anterior coxae and trochanter entirely light fuscous; femora with external surface variously marked with dark fuscous but not covering more than one-half total surface, internal surface usually dark, rarely light, tibiae with three or four dark transverse bands; tarsi with metatarsus dark, remainder light. Median femora with a dark apical and a lighter submedian band, tibiae with dark apical and basal bars, and two lighter mesal bars; tarsi light. Posterior femora as median one; tibiae essentially as median one except the basal and apical bars are wanting.

Measurements (in millimeters)

	Length of body [6] (excluding ovipositor)	Length of anterior wing	Length of pronotum	Length of anterior femur
♂				
Boulder Springs, Ariz.	—[6]	11	1.5	3
Boulder Springs, Ariz.	—[6]	13	2	3.4
Prescott, Ariz	11.5	13	1.8	3.3
Hot Springs, Ariz.	9	11.8	1.8	3.5
Oroville, Cal.	10.4	11.8	1.8	3.4
Oroville, Cal.	—[6]	12	1.8	3.5
♀				
Hot Springs, Ariz.	7	10	1.6	2.5
Oroville, Cal.	8.5	11	1.5	3
San Jacinto Mts., Cal. ...	8.9	12.8	2	3.4
Wagon Pass, Cal.	—[7]	10.6	1.7	3

Distribution.—This species has often been confused with the new forms here described and as a result but very little is known of its distribution. The present form is definitely known from the slopes on both sides of the Colorada-Gila desert tract, the western Mohave desert and scattered localities in or bordering the Sacramento-San Joaquin valley.

Specimens examined: 12; 7♂, 5♀.

ARIZONA: Mohave Co.; Boulder Springs, near Kingman, June 11, 1920, (O. C. Poling), 2♂, [A.N.S.P.]. Yavapai Co.; Prescott, July 7, 1902, (Oslav, 1♂, [M.C.Z.]: Hot Springs, June 27, (Barber and Schwarz), 1♂, 1♀, [U.S.N.M.].

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[6] As most of the males have had the apex of the abdomen removed, it is not possible to give the total length.

[7] Abdomen broken.

CALIFORNIA: Butte Co.; Oroville, July 13-15, 1926, (H. H. Keifer), 2♂, 1♀, [Cal. Acad. Sci.]. Los Angeles Co.; Lancaster, July 31, 1897, (A. P. Morse), 1♂, [M.C.Z.]. Kern Co.; Fort Tejon, 1879, (F. Brown), 1♀ (type), [M.C.Z.]. Riverside Co.; San Jacinto Mts., below 6000 ft., July 29, 1912, (J. C. Bridwell, in Chaparral), 1♀, [U.S.N.M.]. San Diego Co.; Wagon Pass, 5 miles east of Jacumba, 3700 ft., September 15, 1922, (Rehn and Hebard), 1♀, [A.N.S.P.].

Plega fratercula new species (Figs. 4, 7.)

This form, the smallest of the genera, is related to *signata* and *banksi* but differs by having five digitiform processes on the parameres while the former has three of these and the latter has seven, also these processes are more or less intertwined, and in this respect show some resemblance to the condition found in *dactylota*. The median process of the tenth sternite is arcuate and the distal extremity is weakly recurved, a condition unique among the members of the genus.

Type.—♂. Capitan Mountain, Gila County, Arizona. August 8, 1933. (R. Anderson.) [Museum of Comparative Zoölogy.]

Differing from *signata* only in the following features: its much smaller size; head slightly broader than high; pronotum quite short and broad, practically subquadrate. Genitalia: parameres relatively stout, their apices supplied with five intertwined digitiform processes (see figure 4), median lobe of tenth sternite rather prominent, its margins arcuate and its distal apex slightly recurved (see figure 7).

Allotype.—♀. Same data as type except, July 24, 1933. [Museum of Comparative Zoology.]

Essentially like type except that the pronotum is half again as long as broad and the abdominal apex is essentially as in *signata*.

Pattern. Rather strikingly contrasted but mostly dark. Light pattern as follows: lateral and apical margins of clypeus and labrum a narrow, often broken light line along inner margin of eye, supra-antennal spots quite small, vertex with convergent light bars, median spot subobsolete. Pronotum with lateral light bars passing posteriorly into light posterior portion of lateral lobes, these lines tending to be broken near middle, posterior portion of dorsum light. Anterior coxae and trochanters light fuscous, anterior femora either dark or mottled externally, internally light or dark fuscous. Median femora fuscous except for subapical and apical light bands, tibiae with fuscous basal, apical and submedian bands, posterior femora and tibiae with dark basal and apical bands.

Measurements (in millimeters).—Length of body: 4.5 type, 7 allotype; length of anterior wing: 7 type, 9 allotype; length of pronotum: .8 type, 1.4 allotype; length of anterior femur: 1.8 type, 2.4 allotype.

Distribution. — This diminutive form is known only from Capitan Mountain and near Globe.

Specimens examined: 3; 1♂, 2♀.

ARIZONA: Gila Co.; Globe, July 17, 1933, (Parker), 1♀, [M.C.Z.]; Capitan Mt.; July 24–August 8, 1933, (R. Anderson), 1♂, 1♀ (type, allotype), [M.C.Z.].

Plega banksi [8] new species (Figs. 1, 6, 15.)

This species from southern Arizona closely resembles in practically all external features *signata* Hagen and *dactylota* but differs from these in the character of the male genitalia. The parameres of *banksi* are quite long, relatively slender and tapered distad, and are supplied with seven, including median, quite slender and tapering digitiform processes which are in the same general plane as the shaft of the paramere, while in *signata* there are only three digitiform processes and *dactylota* has nine of the processes and they are directed at an angle from the shaft, also the median process of the tenth sternite of *banksi* is distinctive as it is bluntly falcate while in the other North American forms of the genus it is more or less lobate.

Type.— ♂. Kits Peak Rincon, Balboquivari Mountains, Pima County, Arizona; 31° 57′ N. 111° 32′ W.; about 4050 feet. August 1–4, 1916. (Lutz and Rehn.) [American Museum of Natural History.]

Agreeing with *signata* Hagen in all essential features except as follows: inner margin of eyes slightly concave, posterior fourth of pronotum fused along mid-ventral line: subgenital plate somewhat produced distad, apex rounded, no trace of a carina, a shallow medio-longitudinal sulcus in distal portion. Genitalia: parameres quite long, relatively slender and distinctly tapering, distad with seven, including median one, which actually is distal extremity of paramere, tapering, simple digitiform processes which are in the same general plane as shaft of paramere, these processes all closely adpressed to one another and to shaft (see figure 1); median process of tenth sternite distinctly falcate, its greatest length equal approximately twice greatest basal width, both dorsal and ventral margins arcuately convergent to the obtuse, rounded apex (see figure 6).

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[8] Named for Mr. Nathan Banks of the Museum of Comparative Zoölogy, in appreciation of his cordial cooperation and his numerous contributions to North American Neuroptera.

Allotype.—♀. Same data as type. [American Museum of Natural History.]

Agreeing with the male in all features except for the apex of abdomen which is similar to that of the female of *signata.*

Pattern essentially as in *signata* except as follows. the inter-antennal bar is usually absent or but very faintly indicated, at times reduced to a simple spot near clypeal margin; supra-antennal spots and light area margining inner eye margin usually not produced towards each other, medio-longitudinal spot on vertex usually more or less anchor-shaped, at times ovate. Pronotum with posterior third usually rather dark, light dorso-lateral lines passing posteriorly into light ventro-lateral areas. Internal surface of anterior femora either entirely light or dark. Median femora with a dark apical and a dark submedian band; tibiae with dark apical and basal bars and two dark median ones. Posterior femora with a dark apical bar; tibiae with dark basal and apical bars.

Measurements (in millimeters)

	Length of body (excluding ovipositor)	Length of anterior wing	Length of pronotum	Length of anterior femur
♂				
Kits Peak Rincon (type) ..	—[9]	12.5	2.1	3.6
Kits Peak Rincon (paratypes)	7.6–13	9.3–14	1.4–2.2	3–3.9
Oracle (paratypes)	11.5	12.3	1.7	3.5
Santa Rita Mts. (paratype)	11	12.3	2	3.8
Superior (paratype)	10.5	12	1.8	3.5
Reddington (paratype) ..	10.4	13	1.9	3.5
♀				
Kits Peak Rincon (allotype)	11	13.5	2.4	3.9
Kits Peak Rincon (paratypes)	7.6–12.5	9.6–15.2	1.8–2.5	2.9–4
Oracle (paratype)	12	15.5	2.5	4
Santa Cruz Village	8.6	10	1.8	2.7
Comobabi Mts.	7.5	9.3	1.7	2.5
Black Dike Prospect	12.2	15.2	2.5	4.1

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[9] The apex of the abdomen has been removed in order to examine the genitalia and as a result it is impossible to give the total length.

Paratypes.—We are considering as paratypes all of the material from the Baboquivari Mountains as well as the one specimen from the Santa Rita Mountains and the material from near Oracle, Reddington and Superior.

Distribution.—This species is known in south central Arizona in the valleys and into many of the mountain ranges up to an altitude of between four and five thousand feet. Also I have examined a single pair of this form from Indian Garden in the Grand Canyon.

Specimens examined: 25; 12♂, 13♀.

ARIZONA: Coconino Co.; Indian Garden, Grand Canyon, about 3800 ft., July 23, 1934, (E. L. Bell), 1♂, 1♀, [A.M.N H.]. Pinal Co.; Boyce Thompson Arboretum, Superior, August 1-3, 1937, 1♂ (paratype), [M.C Z.]: 14 miles east of Oracle, July 27, 1924, (E. P. Van Duzee), 1♂, 1♀ (paratype), [Cal. Acad. Sci.]. Pima Co.; Reddington, (W. Barnes), 1♂ (paratype), [U S. N. M.]: Comobabi Mts., 32° 2′ N., 111° 45′ W., about 3425 ft., August 9-10, 1916, (Rehn and Lutz), 1♀, [A M.N.H.]: Santa Cruz Village, Cobabi Mts., 32°, 1′ N., 111° 54′ W., about 3100 ft., August 10-12, 1916, (Rehn and Lutz), 1♀, [A.M.N.H.]: Black Dike Prospect, Sierritas, 31° 56′ N., 111° 16′ W., about 3750 ft., July 26-29, 1916, (Rehn and Lutz), 1♀, [A.M N.H.]: Baboquivari Mts., August 11, 1924 (♂), and August 15, 1922 (♀), (O C. Poling), 1♂, 1♀, (paratypes), [Cal. Acad. Sci.]: Kits Peak Rincon, Baboquivari Mts, 31° 57′ N., 111° 33′ W., about 4050 ft., August 1-4, 1916, (Rehn and Lutz), 5♂, 6♀ (type, allotype and paratypes), [A. M. N. H. and A. N. S. P.]: Near Kits Peak Rincon, Baboquivari Mts., 32° 0′ N., 110° 36′ W., about 3600 ft., August 7-9, 1916, (Rehn and Lutz), 1♂, 1♀ (paratypes), [A.M.N.H. and A.N.S.P.]. Pima-Santa Cruz Co.; Santa Rita Mts., 4000 to 5000 ft., August 25, 1924, (A. A. Nichol), 1♂ (paratype), [M.C.Z].

Plega dactylota dacylota[10] new species (Figs. 3, 5, 9, 17, 18, 21, 22.)

This widespread species and its race *lipanica* are in all essential external morphological features very similar to *signata* and *banksi* but the male genitalia are quite distinctive as in the present form the parameres are relatively stout and their apices appear clubbed due to the nine digitiform processes which are closely adpressed among themselves, and are directed at an angle from the shaft of the paramere while in *banksi* there are only seven of these processes and they are in the general plane of the shaft and *signata* has but three and *fratercula* but five of these processes. Moreover, the median process of the tenth sternite is lobate in *dactylota* and not falcate as in *banksi* nor recurved apically as in *fratercula*. The nominate form of the present species may be distinguished from its race *lipanica* by the former having the distad margin of the median lobe of the tenth sternite rounded while in *lipanica* this lobe is obtuse angulate distad. Also the light dorso-lateral bars of the pronotum usually are not broken and extend freely into the posterior light area in the nominate form instead of these lines being broken behind the anterior constriction and the light line along the inner margin of the eye is either connected with or produced toward the supra-antennal spots while in *lipanica* this line is at most, and only rarely, produced toward the supra-antennal spots.

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[10] Δακτύλωτός—with finger-like handles.

Type.—♂. Kingman, Mohave Co., Arizona. July 20, 1920. (O. C. Poling.) [Academy of Natural Sciences of Philadelphia, type no. 9099.]

Essentially like *signata* and agreeing with it in all important features except as follows: head slightly broader, height of eyes equal, almost exactly, to one-half height of whole head, inner margin of eye weakly arcuate. Greatest width of pronotum equal to slightly more than one-half of length of pronotum. Genitalia: parameres relatively short and rather heavy, apices apparently clubbed due to the nine digitiform processes which are adpressed among themselves and which are directed at an angle from the shaft (see figures 3, 5), these processes are apparently articulate, a condition not noticed in the other species examined; tenth sternite with median process lobate with all margins weakly arcuate (see figure 9).

Allotype.—♀. Wheeler Canyon, Hualapai Mts., Mohave Co., Arizona. September 1, 1920. (O. C. Poling.) [Academy of Natural Sciences of Philadelphia.]

Similar to the male in all features except abdominal apex, in the features of which it agrees with the female of *signata*.

Pattern. General color light with a dark pattern as noted under *signata* except as follows: head with the following light areas, marginal area of clypeus and labrum almost always light, at times a median light stripe, rarely almost entirely light; usually some trace of an inter-antennal longitudinal bar, at times absent or represented by a small supra-clypeal spot or quite distinct and distinctly broadened ventrad, at times a light area between antennal socket and inner eye margin, this often connected with light line along inner margin of eye; supra-antennal spots usually quite distinct, often produced toward line along inner eye margin or this line produced toward them or both produced; medio-anterior spot or vertex varying from elongate oval to anchor-shaped or even trident-shaped, this area bounded by the usual dark and light areas. Pronotum usually dark except for dorso-lateral longitudinal bars, however a light medio-longitudinal line in posterior half is evident in some individuals and rarely the posterior portion of disk is light, the dorso-lateral bars usually are continuous throughout the length of the pronotum and pass into the lateral light portions although they often are broken at anterior constriction and rarely commence behind this constriction. Anterior coxae usually light fuscous, rarely rather dark, usually with a rather dark distal bar. Anterior femora with external surface variously marked with transverse dark bars or blotches, never entirely dark and very rarely entirely light, internal surface usually entirely dark, rather mottled. Median legs essentially as in *stignata* and posterior ones like median legs.

Paratypes.—I am considering as paratypes all of the Arizona material from localities where males have been captured. Thus material from the following localities is considered paratypic; Kingman, Wheeler Canyon, Prescott, Globe, Sabino Basin, Rock Canyon, Santa Rita Mountains, Paradise, Reef, Huachuca Mountains, Patagonia and the Washington Mountains.

Measurements (in millimeters)

	Length of body (excluding ovipositor)	Length of anterior wing	Length of pronotum	Length of anterior femur
♂				
Duchesne, Utah	11	14.6	2	4
Kingman, Ariz. (type)	—[11]	12.8	1.8	3.9
Kingman, Ariz. (paratypes)	—[11]	12–13.3	2.1–2.3	3.3–4
Globe, Ariz. (paratypes)	8.5–8.7	10–11.5	1.7–1.8	3.1–3.5
Santa Catalina Mts., Ariz. (paratypes)	9–10	10–14	1.6–2.3	3–4
Huachuca Mts, Ariz. (paratypes)	9.8–13.7	12.1–16	1.6–2.3	3.5–4.5
♀				
Stockton, Utah	13	19.5	2.3	4.8
Charleston, Nev.	13.5	16.8	2.2	4.8
Yucca, Ariz.	11.5–12	15–15.1	2–2.2	4.5–4.7
Wheeler Canyon, Ariz. (allotype)	9.9	12.6	1.6	3.2
Globe, Ariz. (paratypes)	8–9	12–12.3	1.6–1.7	3.2–3.8
Palmerlee, Ariz.	10–13	14.6–17.8	1.8–2.3	3.5–4.3
Huachuca Mts., Ariz. (paratypes)	9.5–13	13–18.8	1.6–2.4	3.5–4.1

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[11] These specimens have had the apex of the abdomen removed for examination of the genitalia and as a result it is not possible to give the total length.

Distribution.—This form is distributed over an area extending diagonally from Cochise County to Mohave County, Arizona, and to Charleston, Nevada, and also two records from Utah, Stockton and Duchesne. The altitudinal range is from 1800 feet, Yucca, to over 5000 feet, Prescott, Stockton, Duchesne and in some of the mountains of southern Arizona. Typically the species is found in the Upper Sonoran life zone although it may infringe on the Transition zone and the Lower Sonoran zone, but it is apparently replaced in the latter by the closely related *banksi*.

Specimens examined: 57; 24♂, 33♀.

Utah: Tooele Co.; Stockton, August 7, 1907, (T. Spalding), 1♀, [Davis Cln.]. Wasatch Co.; Duchesne, June 23, 1935, (F. C. Harmston), 1♂, [M.C.Z.].

Nevada: Nye Co.; Charleston, 3500 ft, August 17, 1919, (Rehn and Hebard), 1♀, [A.N.S P.].

Arizona: Mohave Co.; Truxton, June 16, 1920, (O. C. Poling), 1♀, [A.N S.P.]: Hackberry near Kingman, August 8, 1920, (O. C. Poling), 1♀, [A.N.S.P.]: Kingman, September 3, 1917 (♀), June 2, 1920 (2♂), August 20, 1920 (♂), (O. C. Poling), 3♂, 1♀ (type, paratypes), [A.N.S P.]: near Kingman, May 30, 1920, (O. C. Poling), 1♀, [A.N.S.P.]: Wheeler Canyon, Hualapai Mts., June 10, 1920 (♂), September 1, 1920 (♀), (O. C. Poling), 1♂, 1♀ (paratype, allotype), [A N.S.P.]: Yucca, August 4, 1920, (O. C. Poling), 2♀, [A.N.S.P.]. Yavapai Co.; Prescott, August 21, 1917, (J. A. Kusche), 1♂ (paratype), [A.N.S P.]. Gila Co.; Globe, August 17, 1936, (G. P. Englehardt), 2♂, 2♀ (paratypes), [U. S. N. M.]: vicinity Globe, August 4-5, 1937, (A. B Klots), 1♀, [M C Z.]. Pima Co ; Sabino Basin, Santa Catalina Mts, 32° 22′ N., 110° 46.5′ W., about 3800 ft., July 8-20, 1916, (Rehn and Lutz), 2♂ (paratypes), [A.M.N.H. and A.N.S.P.]: mouth of Rock Canyon, Santa Catalina Mts., 3000 ft., April 24, 1932, (M. Hebard); 2♂ (paratypes), [A.N S.P.]: Apache Camp, Santa Catalina Mts., 5500 ft., July 25, 1917, 1♀, [M.C.Z.]: Tucson, July 15, 1935, (Bryant), 1♀, [M.C.Z.]. Pima-Santa Cruz Co.; Santa Rita Mts., 1♂ (paratype), [U.S.N.M.]: Santa Rita Mts., July 7, (E. A. Schwarz), 1♂ (paratype), [U.S.N.M.]: Santa Rita Mts., 5 to 8000 ft., July, (F. H. Snow), 1♂ (paratype), [M. C. Z.]: Florida Canyon, Santa Rita Mts., August 10, 1924, (E. P. Van Duzee), 1♀, [Cal. Acad. Sci.]. Cochise Co.; Paradise, August 8, 1915, (O.C. Poling), 1♂ (paratype), [A.N.S.P.]: Hereford, 1♀, [M.C.Z.]: Palmerlee, May-June, 3♀, [M.C.Z. and A.M.N.H.]: Reef, August 25, 1♂ (paratype), [M. C. Z.]: Garces, August, (Biederman), 2♀, [M.C.Z.]: Huachuca Mts., July 15, 1♂, 4♀ (paratypes), [U.S.N.M.]: Huachuca Mts., August 1905, (H. Skinner), 1♂ (paratype), [A.N.S.P.]: Huachuca Mts., July 20, 1937, (D. J. Knull and J. N. Knull), 1♂ (paratype), [M.C.Z.]: Carr Canyon, Huachuca Mts., August 5-6, 1924, (J. O. Martin and E. P. Van Duzee), 2♂, 1♀ (paratypes), [Cal. Acad. Sci.]: Carr Canyon, Huachuca Mts., June 23, 1932, (J. O. Martin), 1♂ (paratype), [Cal. Acad. Sci.]. Santa Cruz Co.; Patagonia, August 1, 1924, (E. P. Van Duzee), 1♂ (paratype), [Cal. Acad. Sci.]: Badger, July 31, 1924, (E. P. Van Duzee), 2♀, [Cal. Acad. Sci.]: Washington Mts., 6–7000 ft., July 1919, (Kusche), 1♂ (paratype, [U.S.N.M.]: Washington Mts., July 15, 1920, (J. A. Kusche), 1♂ (paratype), [Cal. Acad. Sci.]: Washington Mts., September 7, 1937, (J. A. Kusche), 1♂ (paratype), [Cal. Acad. Sci.]: Nogales, August 3, 1903, (Osler), 1♀, [A.N.S.P.].

Plega dactylota lipanica[12] new subspecies (Figs. 10, 19, 20.)

This geographic race is quite closely related to the nominate form but may be separated from it by having the light lateral pronotal bars broken behind the anterior pronotal constriction and by these lines never extending more than one-fourth the length of the pronotum while in the typical form these bars usually are continuous and extend at least one-half the pronotal length and pass into the light posterior portion of the lateral surface, also the supra-antennal spots are usually quite distinct from and not produced toward the light line along the inner eye margin, while in *d. dactylota* these lines usually are produced toward each other. The male genitalia show some slight difference in form from that of nominate form as the median lobe of the tenth sternite is obtusely angulate distad instead of being rounded.

Type.—♂. Hills west of Ord Mountains, Brewster County, Texas. June 1-15, 1926. (O. C. Poling.) [Academy of Natural Sciences of Philadelphia, type no. 9101.]

Structurally essentially the same as *dactylota dactylota* except for the median lobe of the tenth sternite which is obtusely angulate distad (see figure 10).

Pattern essentially as in *d. dactylota* except as follows: head with a faint indication of a light inter-antennal stripe, faint light line along inner margin of eye; supra-antennal light spots small, not connected laterally to line along inner margin of eye; vertex medio-anteriorly with a sub-ancorate light spot which has a short, dark median line; laterad of the median portion of this is a pair of ovate light spots; laterad of these a pair of convergent light bars; remainder of head dark fuscous, except for a trace of a light bar which starts at the medio-posterior portion of the eye and continues toward the posterior margin of the head.

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[12] Named after the Lipans who were found through the Rio Grande area.

Pronotum with a light pattern as follows a pair of lateral stripes anteriorly, broken at anterior constriction; posteriorly a trace of a light median line; anterior margin with three light spots, one mesad, the others laterad; lateral portions of posterior half light.

Allotype.—♀. Same data as type except, September 1-15, 1926. [Academy of Natural Sciences of Philadelphia.]

Essentially the same as male except for its somewhat less intense coloration, and abdominal apex, in which it agrees with *d. dactylota*.

Variation.—There is appreciable variation in the pattern of this subspecies but those portions used as diagnostic features are usually constant. Occasionally there appears to be a light lateral band along the pronotum but it is narrowly broken at one or more places. The venation shows some variation as may be seen from the following conclusions; anterior wing with six to eight radial sectors, seven or eight being usual, always four of these from the first radial cell; six to nine gradate veins but eight is the usual number: posterior wing with four to six radial sectors, five or six being usual, always four from the first radial cell; six to eight gradate veins but six or seven being the usual number.

Paratypes.—There are fourteen paratypes, eight females and six males all taken at the same locality during 1926 and 1928 by O. C. Poling.

Measurements (in millimeters)

	Length of body (excluding ovipositor)	Length of anterior wing	Length of pronotum	Length of anterior femur
Hills west of Ord Mts., Texas				
♂ type	—[18]	14	2	3 8
♂ paratypes	9.4–14	12–17	1.5–2.1	3.1–4.5
♀ allotype	16	20.5	2.8	5
♀ paratypes	11.7–16	15.1–20.5	1.8–2.8	3.8–5

Distribution.—This geographic race is known from Brewster and Jeff Davis Counties, Texas, where it apparently is found in the Upper Sonoran zone. It is quite possible that this form occurs over a larger area, and probably in southern New Mexico material intermediate between this and the nominate form will be found.

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[18] The apex of the abdomen has been removed in order to examine the genitalia.

Specimens examined: 19; 8♂, 10♀.

TEXAS: Jeff Davis Co.; Davis Mts., July 2, 1931, (G. P. Englehardt), 1 sex?, [U.S.N.M.]. Brewster Co.; hills west of Ord Mts., May 1-15, 1926 (1♂, 1♀), June 1-15, 1926 (1♂), July 15-22, 1926 (1♀), August 15-22, 1926 (2♂, 2♀), August 22-31, 1926 (2♀), September 1-15, 1926 (1♂, 1♀), September 15-20, 1926 (1♀), 1928 (2♂, 1♀); (O. C. Poling), 7♂, 9♀ (type, allotype, paratypes), [A.N.S.P.]: Big Bend Park, June 13-14, 1937; (R. H. Baker), 1♂, 1♀, [M.C.Z.].

NOLIMA Navas

1914. *Nolima* Navas, Mem. R. Acad. Cien. Artes Barcelona, (3), xi, p. 100.

GENOTYPE (by present designation): *Nolima victor* Navas.

This genus was proposed by Navas for the two new species, *victor*[14] and *praeliator*,[15] which are from Mexico. Previously this genus was not known from the United States but I have before me three new forms from that country.

This curious and rather highly specialized member of the Platymantispinae is very distinct from any of the other genera known from North America. The prolongation of the anterior tibiae as well as the five segmented anterior tarsi will immediately distinguish *Nolima* from *Plega*. While not closely related to *Drepanicus* it agrees with that genus in the characters given above to separate *Nolima* from *Plega*, but differs from *Drepanicus* by having three short, subquadrate radial cells, instead of these being quite long. Moreover, in the present genus subcosta runs into costa at slightly more than one-half the distance to the pterostigma, while in *Drepanicus* subcosta runs to pterostigma and does not join costa.

Key to the forms known from the United States

1. Supra-antennal transverse bar produced ventrad on median line; anterior light areas of pronotum not connected with ventro-anterior areas when the latter are present (greatest width of pronotum equal to five-eighths or exactly two-thirds of greatest length of pronotum)..2

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[14] Mem. R. Acad. Cien. Artes Barcelona, (3), xi, p. 101, fig. 14, (1914). [Sex?; Xucumanatlan, Guerrero, Mexico.]

[15] Mem. R. Acad. Cien. Artes Barcelona, (3), xi, pp. 101, 102, fig. 15. [Sex?; Omiltene and Xucumanatlan, Guerrero, Mexico.]

Supra-antennal transverse bar not produced ventrad on median line; anterior light areas of pronotum broadly connected with ventro-anterior light areas (greatest width of pronotum equal to approximately two-thirds greatest length of pronotum).....*pinal* new species

2. Pronotum with distinct ventro-anterior light areas; metanotum without a chevron-shaped band; greatest width of pronotum equal to two-thirds greatest length..............................*kantsi* new species

Pronotum without ventro-anterior light areas; metanotum with transverse, median chevron-shaped band; greatest width of pronotum equal to five-eighths greatest length........................*dine* new species

Nolima pinal[16] new species (Fig. 14.)

This interesting species, which in general size, most closely resembles *praeliator,* is the largest member of the genus from the United States. From *victor* the present form differs by having the occipital bars sublongitudinal, not oblique, the antennae beyond the base black instead of fuscous. Moreover, the pattern on the dorsum of the pronotum is evidently quite different from that in either of the Mexican forms, as in *pinal* there are two relatively large light blotches near the anterior margin, these being connected with the light ventral and ventro-lateral area, also there is the usual medio-longitudinal light line, while *victor* is said to have two longitudinal dark lines which broaden out anteriorly and, from the other Mexican form, *praeliator,* has a light medio-longitudinal line which is broken behind the middle and paired light lateral longitudinal bars anteriorly. From the two North American forms, here described, *pinal* differs in addition to those characters given in the key, by the distinctive markings of the pronotum and in the pattern of the meso- and metanotum, which are partially discussed above.

Type.—♂. Base of Pinal Mountains, Gila Co., Arizona. September. (D. K. Duncan; oak.) [Museum of Comparative Zoölogy.]

General size slightly more than average for the genus and rather heavy.

Head relatively large, in anterior aspect subcircular, greatest width, across eyes, equal to greatest depth; eyes large, their height equal to one-half that of head, outer margins evenly convex, inner margins very weakly

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[16] Named after the Pinal Coyotero who were the group of the Apache that formerly inhabited the region around Mount Pinal.

concave, convergent ventrad; antennae placed slightly below middle of eyes, basal article relatively large moniliform, second article about half as large as first, moniliform, remaining articles, which are more than twenty-seven, submoniliform, with a ring of stiff setae near apex; labrum transverse, symmetrically trapeziform, clypeus transverse, lateral and apical margin rounded; mandibles with apex acute angulate, labial and maxillary palpi cylindrical except for apical segments, which are fusiform: vertex of head relatively high, vaulted, epicranial suture distinct, area between antenna produced into a broad elevated plate which is concave dorsad, except for its lateral arms which extend obliquely upward above antennal bases, slightly mesal of inner margin of eyes a shallow oblique sulcus; head in lateral aspect slightly flattened, eyes very prominent, in outline subovoid; genae narrow, loriform.

Pronotum relatively short and rather broad, greatest width equal to approximately two-thirds greatest length, infundibuliform, broadest anteriorly, prozona and metazona subequal, anterior margin weakly concave, followed by an almost submarginal concave sulcus, pronotal tubercles very lowly rounded, practically subobsolete, near posterior margin a distinct, subdiamond-shaped concavity, posterior margin subtruncate, feebly emarginate mesad; in lateral aspect pronotum subcylindrical, anterior margin obliquely declivent, posterior margin subtruncate, with two moderately prominent and one weak transverse rugae on ventral surface, fused along venter for two-thirds its greatest length. Prosternum very small; proepisternum small pentagonal, proepimeron trapeziform.

Meso- and metathorax structurally as in other members of the family. Anterior wings relatively short and broad, greatest length slightly more than two and one-half times greatest width; seven or eight costal veinlets, which rarely bifurcate near costa, subcosta passing obliquely into costa at about two-thirds the distance to pterostigma, which is subtrigonal and somewhat thickened, a single cross vein between subcosta and radius, radius subparallel to subcosta to its union with costa, then passing directly to posterior portion of pterostigma; three relatively short radial cells, a single series of gradate veins, for entire venation of genus (see figure 11). Posterior wing in general shape and form approaching that of anterior one but slightly smaller, subcosta soon uniting with costa, radius passing more or less directly to posterior portion of pterostigma, remainder much as in anterior wing (see figure 11).

Abdomen with segments broadly transverse; apical segments with a medio-longitudinal, dorsal carina; ultimate tergite weakly bilobate; ultimate sternite slightly produced mesad, posterior margin broadly arcuate.

Anterior legs rather short and quite stocky; coxae subcylindrical, as long as femora, quite stocky, all except internal face with numerous short, stiff black setae; trochanter subconical, truncate apically and twisted upon its axis; femora quite large and heavy, dorsal margin practically straight, ventral one evenly arcuate, ventro-external margin armed with teeth whose general arrangement is IılıIılıI; discoidal spine elongate, pyramidal, base erect, then passing by an obtuse angulation into the obliquely directed major portion of the shaft; tibiae about two-thirds as long as femora, arcuate, ventro-external margin subcarinate and ventral surface capable of closely apposing ventral surface of femora; tarsi with five articles, articulating with apex of tibiae, metatarsus as long as two succeeding articles, remaining articles short, except for ultimate which is a little shorter than metatarsus, and is supplied with two strongly curved, simple claws.

Median and posterior legs relatively elongate and rather slender; coxae subconical relatively stout, truncate apically; trochanters subconical, slightly twisted upon their axes: femora quite slender and elongate, subcylindrical: tibiae rather slender and elongate, median one about as long as median femora, posterior one somewhat longer than posterior femora; tarsi with metatarsus as long as three succeeding articles, ultimate article rather long, armed with two strong, curved, simple claws, arolium sacular.

General color varying from yellow ocher to buckthorn brown; overlain by the following dark fuscus or blackish markings, head with a transverse, supra-antennal bar that extends upward along the inner margin of the eyes, and extends upward above the antennal bases, occiput with two more or less oblique dark stripes, leaving between them and the supra-antennal bar a light trident-shaped area, a dark spot between and slightly above antennal bases, lower portion of front with two dark spots; antennae beyond two basal articles dark, mandibles with apex blackish: pronotum with dark bars paralleling the light medio-longitudinal stripe, these bars widening out at anterior third and covering most of dorsum posteriorly, antero-lateral margin with a rather narrow dark band; dorsum of mesothorax with four paired cuneate dark dashes, pleura of this segment with ventral portion marked with dark reddish brown; dorsum of metathorax with a median anterior chévron-shaped band, followed by paired dark spots, complete lateral dark bars, and most of posterior portion except for medio-longitudinal light line, dark; pleura essentially as those of mesothorax: abdominal tergites usually margined with dark: anterior femora with two irregular light fuscous blotches on external face, and with an irregular, longitudinal bar on internal face; a short dark line on dorsal surface of anterior tibiae. Wings with pterostigma dark reddish brown, most veins blackish, but costa, subcosta, the basal portion of radius and media varying from yellowish to light fuscous.

Length of body, 11 mm.; length of pronotum, 2.8; length of anterior wing, 12; length of anterior coxa, 3.8; length of anterior femur, 3.8.

This interesting species is known only from the above described specimen from Mount Pinal, Arizona.

Nolima kantsi[17] new species (Figs. 11, 12, 16.)

This species from Texas is one of the smaller species of the genus, resembling in size and structure the related *dine* here described. The distinctive pronotal and meso- and metanotal pattern discussed in the key will separate *kantsi* from *dine,* and the greatest width of the pronotum is equal to two-thirds its greatest length while in *dine* the greatest width of this region is equal to five-eighths its greatest length. The indistinct and quite different occipital pattern will separate this form from *praeliator* which has a median tear-shaped light area and two lateral subovoid light areas.

Type.—♂. Chisos Mountains, Brewster Co., Texas. July 16, 1921. (C. D. Duncan.) [California Academy of Science.]

General form and structure, essentially as in *pinal* except as follows: size somewhat smaller, and more slender, head in anterior aspect subovoid, greatest width equal to one and one-third times greatest depth, inner margin of eyes relatively straight, more strongly convergent ventrad, antennae placed slightly above middle of eyes, second article subcylindrical; vertex of head slightly lower.

Pronotum with greatest width equal to two-thirds greatest length, metazona slightly longer than prozona, anterior margin practically truncate, submarginal sulcus scarcely indicated, pronotal tubercles practically indistinguishable, near posterior margin a shallow trigonal concavity, in lateral aspect, anterior margin subvertical, with three very weak rugae on ventral surface and with a flange-like process behind the proepisternum and proepimeron.

Anterior wings with only six costal veins: as the apex of the abdomen is greatly distended it is not possible to describe the details of this region.

Anterior legs with coxae about as long as femora, teeth on ventro-external margin of femora with essentially the same as in *pinal,* but with a less definite arrangement.

General pattern differing from that of *pinal* as follows: supra-antennal bar definitely produced ventrad on median line between the antennae; dorsal and lateral portions of pronotum dark except for the light medio-longitudinal line, the paired subovoid anterior blotches and the paired longitudinal dashes which are near the anterior-lateral angle and paired postero-lateral light areas: mesonotum with definite longitudinal bars and with lateral bars, these two sets joined posteriorly, metanotum with pattern essentially like that of mesonotum: anterior femora with a dark wash over most of external face, inner face light, tibiae with one or two dark spots on dorsal surface.

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[17] Named after the Lipan Indians, who were given the name Kantsi by the Caddo.

Length of body, 8 mm.; length of pronotum, 1.6; length of anterior wing, 9; length of anterior coxa, 2; length of anterior femur, 2.

This species is known only from type male from the Chisos Mountains of Texas.

Nolima dine[18] new species (Fig. 13.)

This species which is the smallest member of the genus, is most closely related to *kantsi*, here described. The distinctive pronotal and meso- and metanotal markings, as discussed in the key, will separate *dine* from *kantsi* as will the somewhat narrower pronotum whose greatest width in this form is equal to five-eighths the length of the pronotum while in *kantsi* the greatest width is equal to two-thirds the greatest length. The above mentioned pattern as well as that of the occiput will separate this form from the Mexican *praeliator.*

Type.—♂. Pepper Sauce Canyon, Santa Catalina Mountains, Pima Co., Arizona. August 16, 1924. (J. O. Martin.) [California Academy of Science.]

General structure essentially as in *pinal* except as follows: smaller and more slender; greatest width of head equal to one and one-third times the greatest depth, height of eyes slightly greater than one-half that of head, inner margin of eyes more weakly concave, antennae placed very slightly below the middle of the head, in lateral aspect eyes more prominent, globose.

Pronotum with greatest width equal to five-eighths greatest length, metazona distinctly longer than prozona; anterior margin truncate, no submarginal sulcus, at most weak traces of this structure, pronotal tubercles not discernable, near posterior margin a semicircular concavity; in lateral aspect anterior margin subvertical, with one definite transverse ruga on ventral surface.

.Anterior wing with pterostigma more semicircular, less trigonal.

Anterior legs with coxae slightly longer than femora, dorsal margin of femora weakly arcuate, teeth on ventro-external margin essentially as those in *pinal* except that there are often two of the smallest elements together.

General pattern and color much as in *pinal* except as follows: supra-antennal transverse bar produced ventrad along median line, between the antennae, no dark spot between and above antennal bases, in addition to two spots on lower portion of front, a small median spot: pronotum dark dorsad and laterad except for the light medio-longitudinal line, the light paired anterior blotches and the postero-lateral light areas, ventral portion of pronotum light: mesonotum with two paired, subcircular marks, metanotum with dark chevron-shaped longitudinal bars, median transverse chevron-shaped band and posterior portion mostly dark; pleura mainly dark except for area along suture separating upper and lower portions of the pleura which is light yellowish: anterior femora with faint indication of two fuscous patches on external surface, internal one entirely light, tibiae with two small dark spots on dorsal surface.

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[18] Named after the Apache who often referred to themselves as the Dine.

Length of body, 6.5 mm.; length of pronotum, 1 8; length of anterior wing, 8.2; length of anterior coxa, 2; length of anterior femur, 2.

Allotype.—♀. Same data as type. [California Academy of Science.]

Agreeing with the described male except as follows: greatest width of head slightly more than greatest depth, the apex of the abdomen has the ultimate sternite elongate with a median slit, and it seems probable that the ovipositor, which probably is elongate, is forced through this space.

Color and pattern essentially like that of male except as follows: head lacks median spot on lower portion of front; the mesonotum has faint indications of the dark pattern and has anteriorly two dark cuneate dashes.

Length of body, 6.2 mm.; length of pronotum, 1.5; length of anterior wing, 7.3; length of anterior coxa, 2; length of anterior femur, 2.

In addition to those described specimens we had before us a single male, collected by E. P. Van Duzee at the type locality on August 17, 1924, which we are considering a paratype. This specimen agrees in all essential respects with the described individuals but does lack to some degree the definiteness of the pattern, which is usually found in this form, and is in general appearance rather soft. It seems probable that this specimen is a recently emerged one that has not thoroughly hardened and colored.

EXPLANATION OF FIGURES 11 TO 22

PLATE XIV

Fig. 11.—*Nolima kantsi* new species. Wings. (type). Chisos Mts. (Greatly enlarged.)

Fig. 12.—*Nolima kantsi* new species. Dorsum of thorax. (type). Chisos Mts. (Greatly enlarged.)

Fig. 13.—*Nolima dine* new species. Dorsum of thorax. (type). Pepper Sauce Canyon. (Greatly enlarged.)

Fig. 14.—*Nolima pinal* new species. Dorsum of thorax. (type). Pinal Mts. (Greatly enlarged.)

Fig. 15.—*Plega banksi* new species. Phallus (paratype). Kingman. (Greatly enlarged.)

Fig. 16.—*Nolima kantsi* new species. Front view of head. (type). Chisos Mts. (Greatly enlarged.)

Fig. 17.—*Plega dactylota dactylota* new species. Front view of head of female. Charleston. (Greatly enlarged.)

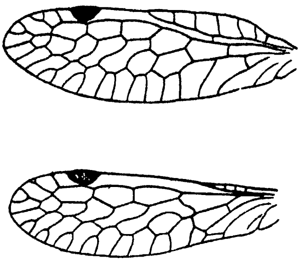
Fig. 18.—*Plega dactylota dactylota* new species. Side view of pronotum of female. Charleston. (Greatly enlarged.)

Fig. 19.—*Plega dactylota lipanica* new subspecies. Side view of pronotum of female (allotype). Hills west of Ord Mts. (Greatly enlarged.)

Fig. 20.—*Plega dactylota lipanica* new subspecies. Front view of head of female. (allotype). Hills west of Ord Mts. (Greatly enlarged.)

Fig. 21.—*Plega dactylota dactylota* new species. Parameres and tenth sternite. (paratype). Kingman. (Greatly enlarged.)

Fig. 22.—*Plega dactylota dactylota* new species. Wings of female. Charleston. (Greatly enlarged.)



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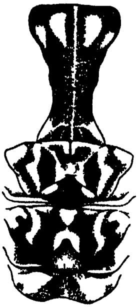

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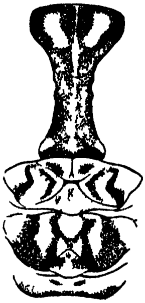

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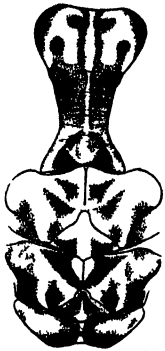

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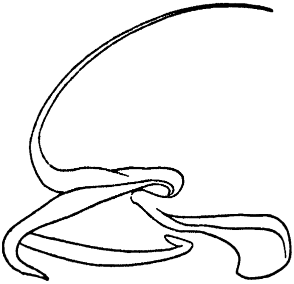

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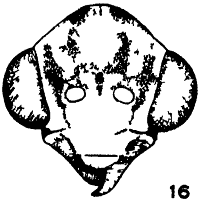

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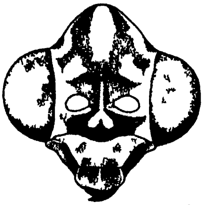

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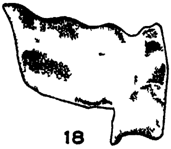

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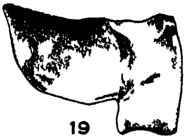

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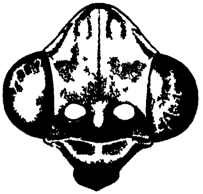

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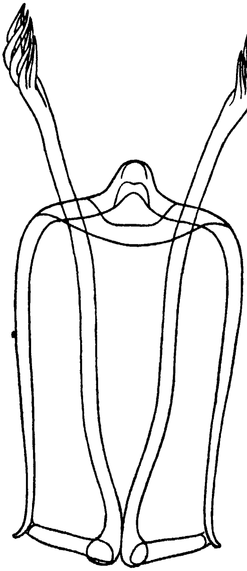

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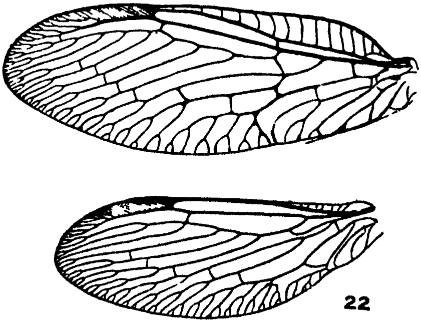

22

REHN—AMERICAN MANTISPIDAE

A GENERIC REVISION OF THE NORTH AMERICAN NOMADIDAE

(HYMENOPTERA)

BY E. G. LINSLEY AND C. D. MICHENER
University of California

(Plates XV to XVIII)

The bees considered in the present paper have been placed in several different families or subfamilies by various authors. Schmiedeknecht (1882) and Robertson (1903) included them in the Melectidae. Friese (1895) placed the group of genera related to *Ammobates* near *Coelioxys* and *Dioxys* in his subfamily Coelioxinae and the Epeoline and Nomadine genera near *Melecta* and *Crocisa* in his subfamily Nomadinae. This system was essentially followed by Ashmead (1899) except that he gave the Nomadinae family rank and considered the Coelioxinae as a subfamily of the " Stelidae ". Cockerell and Robbins (1910), on the basis of the Rocky Mountain fauna, restricted the Nomadidae to the genus *Nomada* and placed the remaining genera in the Melectidae, and utilized the subfamily name Neolarrinae for the relatives of *Ammobates*. Viereck (1916), redefined the Nomadidae to include the Epeoline and Ammobatine genera. The most recent and most thorough account of these bees has been given by Grütte (1935). He dispenses with the family Nomadidae and distributes the genera either in the Panurgine or Anthophorine groups or in an intermediate position between them.

The Nomadidae, as here defined, includes those bees without a pollen-collecting apparatus which have a long tongue, the first two segments of the labial palpi elongate and sheath-like, a pygidial area primitively present in both sexes (thus distinguishing them from the Megachilidae, etc.), no indication of subantennal plates or facial foveae (in contrast to the Panurgidae and Andrenidae), and with a more or less even distribution of sculpturing and pubescence on the forewing and a short, transverse nervellus in the hind wing (both of which characters separate them from the parasitic Anthophoridae). There is a possibility, as suggested by Grütte, that the family as thus defined may actually be polyphyletic. At the present writing, however, the evidence for such an origin does not appear conclusive. In our opinion the group is related to the Anthophoridae and should probably follow it in any linear arrangement of families.

The phylogeny of the nomadid genera is very difficult to interpret. The genera appear to be ancient and their morphological differences are very great, their similarities obscure. The family is distributed throughout the world and since some of the groups are better represented in the Old World than in America, it has seemed inadvisable to attempt a detailed phylogenetic study in the absence of abundant exotic material. Such a work, however, is being undertaken by Mr. V. B. Popov, and the present paper may be regarded as preliminary to his more comprehensive treatment, which we hope will appear at some time in the near future.

In the following pages we have attempted to describe the North American genera on a comparative basis, to arrange them under various higher categories as an indication of the degree of their relationship, to illustrate some of their more important characters, and to give a key for their separation. It should be borne in mind, however, that in drawing up the descriptions for the larger genera it has not been possible to see all of the described species, and we have had to offset this disadvantage by basing the descriptions on a limited number of species representative of the various subgroups known to us. Thus there is a possibility that the characters enumerated for *Nomada, Epeolus,* and *Triepeolus* may not be absolute.

The writers wish to express their appreciation to Mr. P. H. Timberlake, Dr. T. D. A. Cockerell, and Mr. V. B. Popov, for encouragement in the present study, to Mr. E. T. Cresson, Jr.,

of the Academy of Natural Sciences of Philadelphia, Mr. E. P. Van Duzee of the California Academy of Sciences, Miss G. A. Sandhouse of the United States National Museum, Mr. H. F. Schwarz of the American Museum of Natural History, Dr. J. McDunnough of the Canada Department of Agriculture, and Dr. R. H. Beamer of the University of Kansas, for the loan of material or the privilege of studying certain types in their care. Mr. Timberlake, Dr. Cockerell, and Messrs. G. E. and R. M. Bohart have also assisted greatly through the loan of specimens from their private collections. Mr. Popov has kindly read the manuscript and offered certain valuable suggestions which are acknowledged separately in the text.

Key to the Genera of North American Nomadidae

1. Labrum nearly twice as long as broad; pygidial area present, at least in the male; pseudopygidial area of female absent................2
   Labrum broader than long........ 3
2. Body more finely punctate, shining, vestiture not squamiform; antennae of male thirteen-segmented; postero-lateral angles of abdominal tergites rounded; fifth tergite of female without a median ridge; sixth tergite of female partially exposed, without a well-defined pygidial plate..*Oreopasites*
   Body very coarsely punctate, subopaque, vestiture squamiform; antennae of male twelve-segmented; postero-lateral angles of abdominal tergites right-angular; fifth tergite of female with a median, longitudinal ridge; sixth tergite of female concealed by fifth and bearing a large pygidial plate...........................*Neopasites*
3. Antennal scape, excluding insertion, at most twice as long as broad; wings with two submarginal cells (rarely one), the second shorter than the first (occasionally in *Gnathopasites* the two are subequal)..4
   Antennal scape, excluding insertion, more than twice as long as broad; wings with three submarginal cells (rarely two, in which case the two are usually subequal in length)...............................6
4. Mandibles simple; antennae of male thirteen-segmented; second submarginal cell receiving only one recurrent nervure, the first recurrent interstitial with or basad to the first transverse cubitus; sixth abdominal tergite of female small, rounded or notched, never broadly emarginate at apex, with a pygidial plate........................7
   Mandibles bidentate; antennae of male twelve-segmented; second submarginal cell receiving both recurrent nervures; sixth abdominal tergite of female large, apex broadly emarginate, without a pygidial plate..*Gnathopasites*

5. Marginal cell truncate, at most but little larger than stigma; second submarginal cell absent or much wider than long; venation of posterior wings reduced; seventh tergite of male without a pygidial plate but produced to an apical process; mandibles distinctly crossing over in repose .... *Neolarra*
   Marginal cell narrowly rounded, very much longer than stigma; second submarginal cell present, longer than wide; seventh tergite of male with a distinct pygidial plate; mandibles lying one above the other in repose .... *Townsendiella*
6. Axillae acutely produced; maxillary palpi short, with only one or two free segments; pubescence squamiform 7
   Axillae rounded; maxillary palpi longer, with from three to six free segments; pubescence not squamiform (subsquamiform in *Protepeolus*) 8
7. Marginal cell as long as or longer than distance from apex to tip of wing, apex narrowly rounded; maxillary palpi usually with two free segments; pseudopygidial area of female usually at least one-half as long as broad, sloping posteriorly, clothed with coarse, dark, erect setae; sixth abdominal sternite of female consisting of two slender, parallel rods, connected anteriorly by a transverse bar and armed at apex with coarse, curved spines and bristles............. *Triepeolus*
   Marginal cell usually shorter than distance from apex to tip of wing, apex broadly rounded; maxillary palpi usually with one free segment; pseudopygidial area of female transverse, clothed with silvery pubescence; sixth abdominal sternite of female large, broad, with a pair of curved, converging, dentate processes............... *Epeolus*
8. Pulvilli short (moderately long in *Triopasites* but slender, not swollen apically); pygidial plate present in both sexes, sixth abdominal tergite of female without a flat, median, apical process, not spinose....9
   Pulvilli longer than tarsal claws, swollen apically; pygidial plate absent in both sexes, replaced in female by a narrow, median, flat apical process on the sixth abdominal tergite, with a row of spines on either side .... *Protepeolus*
9. Inner margins of eyes subparallel or converging below; sixth abdominal sternite of female scarcely produced beyond apex of sixth tergite, usually broad, rarely semitubular, apex armed with stout spines; pygidial plate of male broad basally, not spatulate................10
   Inner margins of eyes strongly converging above in the male; sixth abdominal sternite of female produced well beyond apex of sixth tergite, semitubular, apex narrowed and without spines; pygidial plate of male narrowed basally, spatulate .... *Epeoloides*
10. Thorax with the normal convexity, not dorso-ventrally compressed; integument distinctly punctured (vertex and mesoscutum rarely almost impunctate in *Nomada*); flagellum elongate, intermediate segments at least as long as broad; metasternum not large, anterior process, if distinct, not acutely pointed.........................11

Thorax strongly dorso-ventrally compressed; integument smooth, polished, practically impunctate; flagellum short, intermediate segments boader than long; metasternum large, anterior process elongate, broad, acutely pointed.................................*Paranomada*

11. Antennal scape flattened; mandibles with anterior and posterior basal angles almost equally distant from eye; maxillary palpi short, with three or five free segments; fifth abdominal sternite of female produced posteriorly as a broad, hairy process......................12

Antennal scape not flattened; mandibles with anterior basal angle more distant from eye than posterior basal angle; maxillary palpi long, with six free segments; fifth abdominal sternite of female not produced at middle of margin.................................13

12. Wings with three submarginal cells; marginal cell rounded at apex and separated from costal margin of wing; maxillary palpi with three free segments.................................*Triopasites*

Wings with two submarginal cells; marginal cell acutely pointed and not separated from costal margin of wing; maxillary palpi with five free segments.................................*Hesperonomada*

13. Abdomen with distinct, transverse pubescent fasciae; lateral lobes of first abdominal tergite closely appressed to first sternite; sixth abdominal sternite of female bilobed, the lobes margined laterally with a comb-like row of spines; marginal cell rounded at apex, narrowly separated from costal margin of wing..................*Hexepeolus*

Abdomen without transverse, pubescent fasciae; lateral lobes of first abdominal tergite projecting as transparent, ventral flaps; sixth abdominal sternite of female spinose apically but not bilobed; marginal cell acute, not separated apically from costal margin of wing. *Nomada*

Tribe AMMOBATINI

This tribe includes several genera,[1] only one of which (*Oreopasites* Cockerell) occurs in the American fauna. The other genera are found in the Palaearctic and Ethiopian Regions.

The group is characterized by the form of the marginal cell which is obliquely truncate at the apex and usually appendiculate, two submarginal cells with the second about as large as the first (probably formed by the loss of the second transverse cubitus), the absence of a well defined pygidial plate in the female, and the possession of a pleural scrobe. In the genera which we have seen the sides of the face are carinate from below the middle of the eye to the lateral apical margin of the clypeus, the labrum is elongate, the mandibles are simple, the maxillary palpi short, the antennae inserted above the level of the middle of the eyes, pubescence not squamiform, and the pygidial plate of the male is large, occupying the entire apex of the seventh abdominal tergite.

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[1] According to Grütte, the following genera are related to *Ammobates: Omachthes* Gerst., *Morgania* Sm., *Pasites* Jur., *Sphecodopsis* Bisch., *Pseudopasites* Bisch., *Pasitomachthes* Bisch., *Pseudodichroa* Bisch., *Parammobatodes* Popov, *Caesaria* Friese, and *Melanempis* Sauss. Popov (in litt.) states that this group of genera may require further tribal division with the separation of the relatives of *Pasites*.

Grütte ascribes to the group a panurgine origin, but the genera lack some of the characteristic features of that family of bees, such as well defined subantennal plates. About one-third of the genera are parasites of the Nomiinae, the remainder parasitize Panurgids or Anthophorids.

OREOPASITES Cockerell

Oreopasites Cockerell, Bull. Am. Mus. Nat. Hist, XXII, p. 442, 1906. Cockerell and Robbins, Univ. Colo. Studies, VII, p. 183, 1910. Crawford, Ins. Insc. Mens, IV, p. 136, 1916.

The members of this genus are generally smaller than in *Pasites* and *Ammobates,* but they have a similar facies. They differ from both, however, in the narrowly emarginate sixth abdominal tergite. From *Pasites, Oreopasites* further differs by the thirteen-segmented antennae of the male and feebly bilobed or convex scutellum. From *Ammobates* it may also be distinguished by the form of the sixth sternite of the female which is feebly notched at the apex and bears well developed, dorsally projecting, lateral lobes.

Form robust; integument finely punctate, black, abdomen red in female, usually red in male; vestiture not squamiform.

Head: Distinctly narrower than thorax; antennae inserted slightly above middle of eyes, thirteen-segmented in male, scape flattened, three to four times as long as broad, pedicel at least as long as broad, flagellum moderately stout, its intermediate segments conspicuously broader than long; eyes twice as long as greatest breadth; sides of face with carina extending obliquely from below middle of eyes to sides of apex of clypeus; labrum more than twice as long as basal width, widest near base, gradually tapering to apex which is broadly rounded; mandibles simple, robust, outer margins strongly curved, apices lying one above the other in repose; anterior basal angles of mandibles much more widely separated from eyes than posterior basal angles, anterior basal angles, seen from side, far anterior to inner margins of eyes; maxillary palpi short, composed of five free segments on a tubercle; gular groove narrowed posteriorly, broader at base than distance to eye, area between groove and eyes convex.

Thorax: Pronotum with dorsal lobes forming an angle of about 135° when viewed from above, separated by distinctly less than shortest distance between tegulae, their anterior faces broadly concave; mid-dorsal portion of pronotum visible from above, not obscured by mesoscutum; mesoscutum distinctly convex throughout, more strongly so anteriorly, anterior lateral processes, viewed from side, about half as broad as length of tegulae; tegulae oval, less than twice as long as broad; mesepisterna with lateral faces strongly convex, forming broadly rounded angle with anterior face; subtegular plate smaller than pronotal tubercle, separated from it by slightly more than one-half width of pronotal tubercle; axillae rounded; axillae and mesoscutellum sloping posteriorly, not on same plane as mesoscutum; mesoscutellum strongly convex; metanotum and posterior face of propodeum slanting posteriorly; metanotum about one-third as long as mesoscutellum, without median differentiation; propodeal spiracle about in middle of propodeum, lower end slightly posterior to upper end; wings nearly clear; forewings with stigma small and narrow, marginal cell shorter than distance from its apex to tip of wing, rather broadly, obtusely truncate, appendiculate, appendage continued as spurious vein almost to costal margin of wing near apex; submarginal cells two, second submarginal cell as long as first, first recurrent vein intersecting it far from base; metasternum broader than long, its short lateral margins parallel, apex obtusely angulate; anterior coxae distinctly longer than broad; middle coxae nearly as long as distance from their dorsal ends to posterior wing bases; anterior basitarsi with concavity nearly half as long as segment; strigilis with apical emargination acutely angular, inner angle acute and produced, inner margin rather transparent; hind legs robust, spicules of tibiae and tarsi large; first three posterior tarsal segments about as long as tibiae, posterior basitarsi much shorter than remaining tarsal segments together, not quite four times as long as apical width; claws bifid, inner ramus about half as long as outer, broader on anterior tarsi; pulvilli compressed, about one-half as long as claws.

Abdomen: Posterior lateral angles of tergites broadly rounded; first tergite rounded anteriorly, anterior face scarcely concave. Female: Fifth tergite unmodified, largely concealing sixth; sixth tergite hardly exerted, with a small, median, elevated, heavily sclerotized area which is emarginate posteriorly and setose above, in place of a pygidial plate; fifth sternite narrowed posteriorly, with a transverse, curved, subapical ridge, beyond which it is depressed; sixth sternite Y-shaped, a little longer than broad, exposed only at apex, heavily sclerotized throughout, apex slender, notched, base broadly, deeply emarginate; third pair of valvulae robust, hairy throughout, one-half as long as sting. Male: Pygidial area poorly defined, short and broad, apex broadly rounded, not produced as a process; eighth sternite submembranous, apical portion furnished with minute papillae, apex slightly irregular; genital armature elongate oval, stipites clothed beneath with long, simple hairs, sagittae not attaining apices of stipites, clothed externally with moderately long hairs.

GENOTYPE: *Oreopasites scituli* Cockerell (by single reference).

Insofar as known, *Oreopasites* is confined to western North America, occurring from the Rocky Mountains region (Colorado) to the Pacific coast (California). The species are parasitic in the nests of *Nomadopsis* (Panurgidae).

Tribe BIASTINI

This tribe may be characterized by the narrowly rounded marginal cell, two submarginal cells the second of which is usually at least as large as the first and receives both recurrent nervures (possibly the second transverse cubitus lost), the short, broad labrum, and the form of the sixth abdominal tergite of the female which is broadly emarginate and lacks a well defined pygidial plate. In the form of the sixth abdominal sternite of the female, the group is most similar to the Neopasitini (sternite emarginate apically and with a series of spines on the lateral apical lobes), but although perhaps related, it differs markedly from that group in the form of the submarginal cells, short labrum, absence of a female pygidial plate, and the structure of the male genitalia. From the Ammobatini, which have similar submarginal cells, the Biastini may be separated by the rounded marginal cell, form of the labrum, and the broad, emarginate sixth abdominal sternite of the female.

The tribe contains two genera, *Biastes* Panzer (Palearctic) and *Gnathopasites* (*Neopasites* auct.) (Nearctic). The species of *Biastes* are parasitic upon anthophorid and panurgid bees.

GNATHOPASITES new genus

Neopasites Crawford (nec Ashmead), Ins. Insc. Mens., IV, p. 136, 1916. Cockerell, Ann. Mag. Nat. Hist., (9), XI, p. 269, 1923. Popov, Trav. Inst. Zoöl. Acad. Sci. U.R.S.S., II, p. 62, 1933.

This genus is proposed for the species related to the true *Phileremus fulviventris* Cresson and is the *Neopasites* of Crawford (1916), nec Ashmead (see discussion under *Neopasites*). It is isolated in our fauna but is apparently related to the Old World *Biastes*, differing in the bidentate mandibles, reduced maxillary palpi (one to four free segments), and form of the sixth sternite of the female. As yet, the genus has not been found outside of California, and nothing is known of its habits.

Form robust; integument finely punctate, black, abdomen red in female, sometimes red in male; vestiture not squamiform.

Head: Narrower than thorax; antennae inserted opposite middle of eyes, twelve-segmented in both sexes; scape less than three times as long as broad, pedicel broader than long, flagellum with outer segments swollen, much wider than long; eyes twice as long as greatest width; sides of face not carinate; labrum broader than long, apex broadly rounded; mandibles robust, strongly curved, with an inner tooth near apices, which lie one above the other in repose; anterior basal angles of mandibles slightly further from eyes than posterior basal angles, but little anterior to inner margins of eyes; maxillary palpi one- to four-segmented; gular groove anteriorly broader than distance to eye, sides subparallel.

Thorax: Pronotum with dorsal lobes rounded when viewed from above, anterior faces convex, separated by more than shortest distance between tegulae; pronotum overhung by mesoscutum not visible from above mid-dorsally; mesoscutum slightly convex, anterior lateral processes viewed from side nearly as broad as length of tegulae; tegulae elongate oval, nearly twice as long as broad; mesepisterna with lateral faces weakly convex, at acutely rounded angles to anterior faces which are slightly concave; subtegular plate smaller than pronotal tubercle, separated from it by little more than half width of tubercle; axillae rounded; mesoscutellum weakly biconvex; metanotum nearly one-third as long as mesoscutellum, without median elevation; metanotum and posterior face of propodeum slanting posteriorly; propodeal spiracle small, far anterior to middle of propodeum, lower end posterior to upper end; triangular area of propodeum with a median elevation, making base of propodeum in profile subhorizontal; wings dark, mottled with clear areas; fore wings with stigma short and broad, marginal cell slightly longer than distance from apex of cell to tip of wing, separated from costal margin, acute, appendiculate, appendage obscured by darkened membrane; submarginal cells two; second submarginal cell shorter than first; first recurrent vein distad to first transverse cubitus; metasternum much broader than long, short lateral margins subparallel, apex obtusely angulate; anterior coxae about as long as broad; dorso-ventral length of middle coxae about two-thirds as great as distance from their upper ends to hind wing bases; strigilis with inner margin transparent and membranous, apex unnotched ending in a single sharp point; concavity of anterior basitarsus about one-third as long as segment; first three segments of posterior tarsi shorter than tibiae; posterior basitarsi slightly longer than remaining tarsal segments, about five times as long as apical width; anterior tarsal claws incompletely bifid in male, with inner basal tooth in female, remaining claws varying intraspecifically; pulvilli somewhat compressed, about one-half as long as claws.

Abdomen: Posterior lateral angles of tergites broadly rounded; first tergite rounded anteriorly, anterior face concave. Female: Fifth tergite large and strongly convex posteriorly; sixth tergite large, with a poorly defined subbasal elevation but without a pygidial plate, apex broadly emarginate, emargination clothed with short hairs; fifth sternite large, anterior part elevated, separated from the depressed posterior portion by a transverse, submedian, impressed line, apex feebly quadrilobate, lateral lobes obscured by fifth tergite; sixth sternite a little longer than broad, completely concealed, rather large, apex broadly emarginate, posterior lobes armed with recurved spines externally, basal margin broadly emarginate, sides near apical lobes produced as a broad, rounded, dorsal lobe, integument rather thin, disk, in particular membranous, broad band between apical lobes heavily sclerotized, lateral lobes moderately so, posterior lobes strengthened by a slender sclerotized line; third pair of valvulae robust, about two-thirds as long as sting, hairy except at extreme bases. Male: Sixth tergite unmodified; seventh tergite with a well defined pygidial plate occupying entire exposed dorsal surface and forming a broad apical process; seventh and eighth sternites subhyaline; genital armature broad; stipites large, elongate, incurved, densely clothed beneath with long, simple hairs; sagittae slender, not attaining apices of stipites, clothed with a few short hairs externally.

GENOTYPE: *Phileremus fulviventris* Cresson.

Tribe NEOPASITINI

This tribe comprises the *Ammobatoides* group of Grütte, and includes *Ammobatoides* Radoszkowski, *Schmiedeknechtia* Friese, *Neopasites* Ashmead (*Holcopasites*), but not *Biastes*.[2] This latter genus differs markedly in the structure of the male genitalia and certain other characters and apparently represents a different group.

The essential characters of the Neopasitini are the rounded marginal cell, two submarginal cells with the first much larger than the second and usually receiving a recurrent nervure (apparently formed by the loss of the first transverse cubital vein, in marked contrast to the Ammobatini), the presence of a pygidial plate on the sixth tergite of the female, and, according to Grütte, the absence of a pleural scrobe. Unlike the genera of the Ammobatini, the members of this group have a broad, deeply emarginate, sixth abdominal sternite in the female.

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[2] For a discussion of these genera see also: Popov, V. B., Trav. Inst. Zoöl. Acad. Sci. U. R. S. S., II, pp. 51-75, 11 text-figs., 1933.

Ammobatoides is an anthophorid parasite, *Schmiedeknechtia* and *Neopasites* are panurgid parasites. Only the last occurs in the Nearctic fauna.

NEOPASITES Ashmead

Neopasites Ashmead, Psyche, VIII, p 284, 1898. Ashmead, Trans. An. Ent. Soc., XXVI, p. 81, 1899. Cockerell and Robbins, Univ. Colo. Studies, VII, p. 183, 1910. Viereck, Conn. Geol. Nat. Hist. Surv., Bull. no. 22, p. 722, 1916.

Holcopasites Ashmead, Trans. Am. Ent. Soc, XXVI, p. 82, 1899, [no species]. Cockerell, Ann. Mag. Nat. Hist., (7), XII, p. 452, 1903, [no species]. Crawford, Ins. Insc. Mens., III, p. 123, 1915. Crawford, Ins. Insc. Mens., IV, p. 136, 1916. Cockerell and Hicks, Ent. News, XXXVII, p. 108, 1926. Popov, Trav. Inst. Zool. Acad. Sci. U. R. S. S., II, p. 60, 1933. Grutte, Arch. f. Naturgesch., IV, p. 513, 1935.

As has been shown by Popov (1933) this genus is closely related to the Palaearctic *Schmiedeknechtia,* but differs by having the antennae twelve-segmented in both sexes with the segments short and broader than long, the head flattened posteriorly, and the eyes widened toward the base of the mandibles. In the Nearctic fauna the genus is distinct in the very coarse punctation and the longitudinally ridged fifth abdominal tergite of the female. The elongate labrum will separate it from all except *Oreopasites* and the twelve-segmented antennae in the male from all except *Gnathopasites.* From both of these it may be readily distinguished by the presence of a pygidial plate in the female, the squamiform vestiture, and numerous other characters.

Form robust; integument coarsely punctate, black, that of abdomen usually red; body with patches of squamiform vestiture.

Head: Nearly as wide as thorax; antennae twelve-segmented in both sexes, inserted slightly below middle of eyes, scape more than three times as long as broad, pedicel broader than long, flagellum slender, segments at most slightly broader than long; sides of face without carinae; labrum more than twice as long as basal width, widest near base, tapering to the subtruncate apex; mandibles simple, robust, strongly curved, apices lying one above the other in repose; anterior basal angles of mandibles about as near to eyes as posterior basal angles, not or scarcely anterior to inner margins of eyes; maxillary palpi with five free segments on a basal tubercle; area between gular groove and eyes flattened.

Thorax: Pronotum with dorsal lobes appearing rounded when viewed from above, anterior faces convex, separated by distinctly more than shortest distance between tegulae; mid-dorsal portion of pronotum covered by mesoscutum, not visible from above; mesoscutum viewed in profile rather flat except for anterior margin, which is sharply convex; anterior lateral processes of mesoscutum, viewed from side, about as broad as length of tegulae; mesepisterna with lateral faces feebly convex, anterior faces at narrowly rounded right or acute angles to lateral faces; tegulae small, broadly oval, a little longer than broad; subtegular plate smaller than pronotal tubercle, narrowly elongate, separated from tubercle by much less than one-half width of tubercle; axillae and mesoscutellum sloping posteriorly, not on same plane as scutum; axillae rounded; mesoscutellum feebly biconvex, posterior one-fourth vertical and at a strong angle to dorsal surface; metanotum and propodeum vertical; metanotum one-third or more than one-third as long as mesoscutellum, without median elevation; propodeal spiracles rather small, near anterior margins of propodeum, lower end not much posterior to upper end; wings hyaline or slightly dusky; fore wings with stigma narrow and small; marginal cell as long as or longer than distance from apex to tip of wing, narrowly rounded at apex, not or feebly appendiculate; submarginal cells two, second considerably shorter than first, much narrowed costally, first recurrent vein interstitial with or basad to first transverse cubitus; metasternum about as long as or a little longer than broad, apex produced and acutely angulate; anterior coxae a little broader than long; middle coxae less than two-thirds as high as distance from upper ends to hind wing bases; strigilis with apical emargination broadly, shallowly arcuate, inner apical angle acutely produced, inner margin rather transparent; anterior basitarsi with basal concavity about one-third as long as segment; first two segments of posterior tarsi slightly shorter than tibiae; posterior basitarsi about as long as remaining tarsal segments together, between five and six times as long as apical width; claws of female with an inner subapical tooth, of male completely bifid; pulvilli nearly one-half as long as claws.

Abdomen: Segments with an apical and subbasal constriction; posterior lateral angles of tergites two to four narrowly, angularly rounded; anterior face of first tergite concave, at nearly right angles to dorsal surface from which it is separated by a slight, transverse ridge. Female: Fifth tergite obscuring sixth, with a mid-dorsal, longitudinal ridge; sixth tergite with disk rather thin, the posterior margin broadly, lateral margins narrowly, more heavily sclerotized; pygidial area transverse, rounded behind; fifth sternite large, posterior margin feebly emarginate, sides produced to a dorsal angle subapically; sixth sternite longer than broad, concealed or with apical lobes exposed, apex broadly emarginate, the apical lobes elongate, slender, armed at tips with curved spines, basal margin broadly emarginate, sides produced subapically as an angular dorsal lobe; third valvulae more than one-half as long as sting, apical half hairy. Male: Sixth tergite sinuously truncate at apex; seventh tergite, excluding pygidial area, broadly truncate, angles of truncation nearly right-angular, pygidial field rounded behind and extending as a process beyond truncation of segment; seventh and eighth sternites submembranous; genital armature very small and slender, moderately flattened, stipites not differentiated from coxopodites, coxopodites with a few short, simple hairs on underside near apex, sagittae fused.

GENOTYPE: *Philerenus fulviventris*, Ashmead (nec Cresson) * = (*Neopasites eamia* Cockerell).

The bees of this group have been treated by most recent workers under the name *Holcopasites.* The latter genus was erected by Ashmead in 1899 without the inclusion of any species, and it was not until 1916 that this generic name was actually associated in print with that of any species. In the latter year Crawford included a number of forms which had been referred to *Neopasites* as early as 1903 (before *Holcopasites* was validated). He designated *Phileremus illinoiensis* Robertson as the genotype. His type selection was based upon a comparison of the Robertson species with the material in the United States National Museum collection (labeled *Holcopasites pratti* Ashm. ms.) upon which Ashmead had based his generic description. Crawford correctly showed that the genus was very distinct from " *Neopasites* " as typified by *Phileremus fulviventris* Cresson, which Ashmead had designated as the type of the latter genus. However, when Ashmead proposed *Neopasites* (1898) he had before him a misidentified specimen (actually a *Holcopasites sensu* Crawford) under the name of *Phileremus fulviventris.* The characters originally enumerated by Ashmead for *Neopasites* are vague and non-definitive, but from his fuller characterization of the following year (1899), in the same paper in which he proposed the name *Holcopasites,* it is obvious that he did not know the true Cresson species. The actual specimen from which the Ashmead descriptions of *Neopasites* were drawn is in the collection of the United States National Museum and bears the label " *Phileremus fulviventris* Cresson " in Ashmead's own hand. It is a " *Holcopasites* " from Texas and is with little doubt the same as *Neo-*

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* The individual members of the Publication of the American Entomological Society are not in accord with the authors in this selection of a misidentified species as a genotype.

pasites eamia Cockerell. In this example the mouthparts are exposed and are as described by Ashmead, whereas in the type, and until very recently the only known specimen, of *fulviventris,* the mouthparts are concealed and could not be seen.

It still remains an open question among taxonomists as to whether, in determining the type of a genus, the name used by an author or the actual species which he had at hand should be followed. Unfortunately, the International Commission of Zoölogical Nomenclature has declined to make a general ruling in the matter. In our opinion a genus is based on a species, not on a name, and to follow the name arbitrarily irrespective of the original author's intent for the genus would be unscientific and a perversion of the original purpose of the International Code of Zoölogical Nomenclature. Such action would, according to our view, be justifiable only when the generic names involved are old, well-established by common usage, or important in general entomological literature. Since this is not true of the bee genera concerned, we prefer to follow the apparent original intent of the author. With this procedure the genotype of *Neopasites* Ashmead would therefore be *Phileremus fulviventris* Ashmead (nec Cresson) (= *Neopasites eamia* Cockerell). Since the characters by which Ashmead separated his *Holcopasites* from his *Neopasites* are not of generic importance, then *Holcopasites* (as validated by Crawford, 1916) becomes a synonym of *Neopasites,* and the true *Phileremus fulviventris* Cresson must be referred to another genus (see *Gnathopasites*).

Neopasites is primarily a group of the eastern and middle United States and Canada, but it occurs as far south as Texas and west to Arizona. The species of which the habits are known are parasites of *Calliopsis* (Panurgidae).

Tribe NEOLARRINI

This American tribe contains only two known genera, *Neolarra* and *Townsendiella.*

The following characters are shared by these genera, suggesting their relationship: Two submarginal cells (only one in some species of *Neolarra*) with the first much larger than the second and usually receiving the first recurrent nervure (probably indicating that the first transverse cubitus has been lost), the marginal cell separated from the costal margin and either rounded or truncate, the antennae inserted below the level of the middle of the eyes and the scape short and robust, the labrum broader than long, the maxillary palpi usually rather long, the pubescence squamiform, and a pygidial field in the female. In addition, these two genera differ from all others in the fauna by having the elevated parts of the mesoscutellum and axillae on approximately the same plane as the mesoscutum and vertically demarked from the lateral depressed portions of these same sclerites. In spite of all of these similarities, however, *Neolarra* and *Townsendiella* are in many respects quite different, particularly in wing venation (greatly reduced in *Neolarra*), form of the sixth abdominal sternite of the female, and the pygidial area of the male (absent in *Neolarra*) and the structure of the male genitalia. In view of our use of some of these same characters for the separation of tribes elsewhere in the family, it might seem inconsistent not to separate these genera on similar grounds. However, most of the differences (except in genitalia) mentioned above can be explained on the basis of the great size reduction which has taken place in *Neolarra*, and we are inclined to believe that in this case, similarities may possibly be more significant than dissimilarities. There seems to be a marked tendency toward reduction in wing venation in small bees, as for example in such unrelated genera as *Perdita*, *Trigona*, and *Parammobatodes*. In the latter genus the wing venation is remarkably similar to that of *Neolarra*, but it is hard to believe that the two genera are closely related.

TOWNSENDIELLA Crawford

Townsendiella Crawford, Ins. Insc. Mens., IV, p. 138, 1916. Michener, Ent. News, XLVII, p. 181, 1936.

This genus is distinguished from its only known relative, *Neolarra*, by its larger size, more complete wing venation, broadly emarginate, lobed and spinose sixth tergite of the female, etc. At present it is known only from southwestern United States (New Mexico to southern California) and appears to be parasitic in the nests of *Hesperapis* (Dufoureidae).

Form robust; integument finely punctate, black, abdomen usually red; body clothed primarily with squamiform pubescence.

Head: About as broad as thorax; antennae inserted well below middle of eyes, those of female twelve-segmented, those of male thirteen-segmented; scape about three times as long as broad; pedicel broader than long; flagellum slender, its segments at most slightly wider than long; sides of face without carinae; labrum broader than long, apex subangular; mandibles simple, slender, gently curved, apices lying one above the other in repose, anterior basal angles farther from eyes than posterior basal angles, and anterior to inner margins of eyes; maxillary palpi four- or five-segmented; gular groove anteriorly broader than distance to eye, sides subparallel, area between groove and eyes slightly convex; cheeks margined posteriorly by a carina.

Thorax: Pronotum with dorsal lobes forming an angle of about 100° when viewed from above, their anterior faces convex, separated by slightly more than shortest distance between tegulae; mid-dorsal portion of pronotum narrowly visible medially from above; mesoscutum convex, especially anteriorly, anterior lateral processes seen from side about two-thirds as broad as length of tegulae, posterior lateral angles feebly produced; mesepisterna with lateral faces convex, making rounded right-angles with anterior faces; tegulae less than twice as long as broad, narrowed anteriorly; subtegular plate much smaller than pronotal tubercle, separated from it by much less than one-third width of tubercle; axillae and mesoscutellum elevated nearly to plane of mesoscutum; axillae broadly rounded; mesoscutellum weakly biconvex; metanotum and posterior face of propodeum slightly slanting posteriorly; metanotum less than one-third as long as mesoscutellum, with small median elevation; propodeal spiracle rather small, slightly anterior to middle of propodeum, lower end below upper end; wings clear or faintly dusky; anterior wings with stigma small, narrow, marginal cell from two-thirds as long as to longer than distance from apex to tip of wing, apex narrowly rounded, bent away from costa; submarginal cells two, second shorter than first, much narrowed above, first recurrent interstitial with or basad to first transverse cubitus; metasternum broader than long, short sides subparallel, apex obtusely angulate; anterior coxae as long as broad; middle coxae less than two-thirds as long as distance from upper ends to hind wing bases; strigilis with apical emargination obtusely angulate, inner apical tooth blunt, inner margin rather transparent; anterior basitarsi with basal concavity about one-third as long as segment; intermediate and posterior tibiae and tarsi strongly spiculate; posterior tarsi with first three segments as long as or longer than tibia, the basitarsus about five times as long as apical width; claws bifid, inner ramus of posterior pair sometimes shortened; pulvilli about one-half as long as claws.

Abdomen: Segments not depressed or constricted at base or apex, posterior lateral angles of tergites broadly rounded; first tergite rounded anteriorly, slightly concave at base, without a transverse ridge. Female: Posterior portion of fifth tergite, except for an apical row of setae, glabrous, broadly convex; sixth tergite with a posteriorly rounded pygidial plate occupying entire exposed dorsal portion of segment; fifth sternite unmodified; sixth sternite longer than broad, only the posterior lobes exposed, apex broadly emarginate, posterior lobes short, hairy, armed with a few coarse spines, subapical lateral lobes small, acute, projecting dorsally, disk of sternite membranous, narrow lateral margin, most of lateral lobes, and lines across bases of anterior lobes heavily sclerotized; third pair of valvulae a little more than one-half as long as sting, hairy throughout. Male: Sixth tergite unmodified; seventh tergite with entire exposed dorsal surface occupied by a pygidial plate which extends posteriorly as a rounded process; genital armature short, broad, stipites undifferentiated from coxopodites, coxopodites produced dorsally as a short, posteriorly projecting, subapical lobe, ventrally as a short, anteriorly projecting, subapical lobe, the former clothed at apex with long, plumose hairs, sagitae robust, strongly curved downward at apices, clothed externally with very short hairs.

GENOTYPE: *Townsendiella pulchra* Crawford (by single reference).

NEOLARRA Ashmead

Neolarra Ashmead, Bull. Colo. Biol. Assn., I, p. 8, 1890. Fox, Ent. News, IV, p. 292, 1893. Baker, Proc. Ent. Soc. Wash., IV, p. 20, 1896. Cockerell, Bull. Sci. Lab. Denison Univ., XI, p. 41, 1898. Cockerell, Bull. Univ. New Mex., I, p. 41, 1898. Ashmead, Trans. Am. Ent. Soc., XXVI, p. 81, 1899. Cockerell and Robbins, Univ. Colo. Studies, VI, pp. 183 and 190, 1910. Crawford, Ins Insc. Mens., IV, p. 136, 1916. Cockerell, Pan-Pac. Ent., v, p. 105, 1929.

Phileremulus Cockerell, Psyche, (suppl), VII, p. 9, 1895. Baker, Proc. Ent. Soc. Wash., IV, p. 21, 1896. Cockerell, Bull. Sci. Lab. Denison Univ., XI, p. 41, 1898. Cockerell, Bull. Univ. New Mex., I, p. 41, 1898. Ashmead, Trans. Am. Ent. Soc, XXVI, p. 81, 1899. Cockerell and Robbins, Univ. Colo Studies, VII, pp. 183 and 188, 1910. Crawford, Ins. Insc. Mens., IV, p. 136, 1916. Cockerell, Pan-Pac. Ent., v, p. 105, 1929.

The members of this genus are very small and may be readily distinguished from the other American parasitic bees by the reduced wing venation with the marginal cell at most but little larger than the stigma.

Form slender, integument finely punctate, black, abdomen often red; body covered with predominantly squamiform vestiture.

Head: Usually slightly narrower than thorax; antennae inserted much below middle of eyes; antennae of male thirteen-segmented; scape not more than twice as long as broad; pedicel a little longer than broad;

flagellum short, robust, outer segments distinctly wider than long; sides of face without carinae; labrum broader than long, apex subangulate; mandibles simple, slender, nearly straight, apices crossing in repose; anterior basal angles of mandibles much further from eyes than posterior basal angles and considerably anterior to inner margins of eyes as seen from side; maxillary palpi with five free segments; gular groove with sides subparallel, anteriorly broader than distance to eyes; area between gular groove and eyes slightly convex.

Thorax: Pronotum with dorsal lobes forming an angle of about 90° when viewed from above, anterior faces concave, separated by slightly less than shortest distance between tegulae; mid-dorsal portion of pronotum narrowly visible from above; mesoscutum convex, more strongly so anteriorly, anterior lateral processes viewed from side as broad as length of tegulae and with apices angulate, posterior lateral angles of mesoscutellum produced and truncate; mesepisternum with lateral faces strongly convex, with rounded right angles between them and the anterior faces; tegulae less than twice as long as broad, narrowed anteriorly; subtegular plate much smaller than pronotal tubercle and very narrowly separated from it; axillae and mesoscutellum elevated and in same plane as mesoscutum; axillae acute or rounded; scutellum nearly flat dorsally; metanotum and posterior face of propodeum slanting posteriorly; metanotum less than one-third as long as mesoscutellum, with a median, slightly bilobed elevation; propodeal spiracle slender, slightly anterior to middle of propodeum, lower and anterior to upper end; wings clear; anterior wings with stigma long, narrow, marginal cell usually smaller and shorter than stigma, about one-eighth as long as distance from apex to tip of wing, its apex abruptly truncate and briefly appendiculate; submarginal cells one or two; second transverse cubital and second recurrent veins sometimes absent, if present second submarginal and third discoidal cells broader than long; first recurrent vein basad to first transverse cubitus; metasternum broader than long, short sides subparallel, apex obtusely angulate; anterior coxae much broader than long; middle coxae about two-thirds as high as distance from their dorsal ends to hind wing bases; strigilis with apical emargination obtusely angulate, inner apical tooth blunt; anterior basitarsi with concavity more than one-third as long as segment; posterior tarsi with first two segments as long as tibia, basitarsus about as long as remaining segments together, five to seven times as long as apical width; claws bifid in the male with a subapical inner tooth in the female; pulvilli a little more than one-half as long as claws.

Abdomen: Segments not compressed or constricted at bases or apices, posterior lateral angles of tergites rather broadly rounded; first tergite rounded anteriorly, feebly concave at base, not margined above by a transverse ridge. Female: Fifth tergite unmodified; sixth tergite somewhat exposed, rather large and heavily sclerotized, with a short, ill-defined, pygidial field; fifth sternite feebly emarginate at apex; sixth sternite concealed, small, longer than broad, apex narrowly emarginate, posterior lobes with a few hairs, basal emargination broad, lateral lobes absent, integument of sternite submembranous except for apical emargination; third pair of valvulae about one-half as long as sting, clothed with short hairs. Male: Sixth tergite unmodified; seventh tergite produced to a process posteriorly but without a pygidial plate; seventh sternite submembranous, sides rather strongly upcurved; genital armature broad, stipites slender, clothed beneath with moderately numerous, short hairs, sagittae acutely pointed, nearly attaining apices of stipites, clothed externally with a few, short hairs, in addition a pair of long, slender, membranous lobes, densely clothed with short hairs, apparently arise from the inner basal angles of the sagittae and a similar but broad, median, lobe arises beneath the bases of these slender accessory lobes.

GENOTYPE: *Neolarra pruinosa* Ashmead (by single reference).

This genus is dominant in the arid parts of western North America where the species appear to be parasitic in the nests of *Perdita* (Panurgidae). *Phileremulus* Cockerell, as will be pointed out in a later paper, appears to be a subgenus of *Neolarra*.

Tribe NOMADINI

This tribe is dominantly American with only the type genus, *Nomada*, extending its range into the Old World. The majority of the species are parasitic in the nests of andrenid and panurid bees.

The important characters of the group include a long or moderately long marginal cell which is usually not separated at apex from the costal margin, typically three submarginal cells (two in a few genera and in individual species of others), a large pterostigma, a short labrum, the antennal insertion at or above the level of the middle of the eyes, and the presence of a pygidial plate in both sexes. The vestiture is never squamiform, and the maxillary palpi are usually long and five- or six-segmented (rarely three- or four-segmented). It is apparently the most primitive tribe of the family. The presence of weak carinae in some species of *Nomada* along the inner margins of the eyes and extending to the sides of the clypeus and of grooves in this position in *Triopasites* and *Hesperonomada* suggests a relationship to the Ammobatini on one side and the Epeolodini and Epeolini on the other.

The North American genera are divisible into three distinct groups: (1) *Nomada* and *Hexepeolus*, (2) *Paranomada*, and (3) *Triopasites* and *Hesperonomada*. Some of the distinguishing characters of these groups are utilized in the key to genera.

NOMADA Scopoli

Nomada Scopoli, Ann. Hist.-Nat, IV, p. 44, 1770. Lamarck, Syst. An. sans Vert., p. 274, 1801. Latreille, Hist. Nat. Crust. Ins., III, p. 375, 1802. Walckenaer, Faun. Paris., II, p. 112, 1802. Fabricius, Syst. Piez., p. 390, 1804. Jurine, Nouv. Meth. Class. Hymen., p. 221, 1807. Latreille, Gen. Crust. Ins., IV, p. 169, 1809. Latreille, Cons. Gen., p. 439, 1810. Curtis, Brit. Entom., IX, p. 419, 1832. Herrick-Schaeffer, Zeitschr. f. Ent., I, p. 267, 1839. Westwood, Intro. Mod. Class. Ins., (suppl.), II, p. 85, 1840. Lepeletier, Hist. Nat. Ins., Hymen, II, p. 464, 1841. Taschenberg, Berl. Ent. Zeitschr., XXVII, p. 70, 1883. Saunders, Trans. Ent. Soc. Lond., pp. 164 and 261, 1884. Cresson, Trans. Am. Ent. Soc., XIV, (suppl.), p. 129, 1887. Friese, Bien. Eur., I, p. 15, 1895. Bingham, Faun. Brit. India, Hymen., I, p. 463, 1897. Frey-Gessner, Faun. Ins. Helv., Hymen. Apid., I, 158, 1899. Ashmead, Trans. Am. Ent. Soc., XXVI, p. 69, 1899. Cockerell and Atkins, Ann. Mag. Nat. Hist., (7), X, p. 41, 1902. Schmiedeknecht, Hymen. Mitteleur., p. 147, 1907. Cockerell and Robbins, Univ. Colo. Studies, VII, pp. 183 and 193, 1910. Swenk, Nebr. Univ. Studies, XII, p. 13, 1912. Viereck, Conn. Geol. Nat. Hist. Surv., Bull. no. 22, p. 722, 1916. Friese, Eur. Bienen, p. 406, 1923. Friese, Ins. Mitteleur., I, p. 104, 1925. Grütte, Arch. f. Naturg., IV, p. 488, 1935.

Micronomada Cockerell and Atkins, Ann. Mag. Nat. Hist., (7), X, p. 42, 1902. Robertson, Can. Ent., XXXV, p. 173, 1903. Swenk, Nebr. Univ. Studies, XII, pp. 12 and 15, 1912. Rodeck, Am. Mus. Nov., No. 496, p. 6, 1931.

Heminomada Cockerell and Atkins, Ann. Mag. Nat. Hist., (7), X, p. 42, 1902. Robertson, Can. Ent., XXXV, p. 174, 1903. Swenk, Nebr. Univ. Studies, XII, p. 9, 14, 1912. Rodeck, Am. Mus. Nov., No. 496, p. 8, 1931.

Gnathias Robertson, Can. Ent., XXXV, pp. 173 and 175, 1903. Swenk, Nebr. Univ. Studies, XII, pp. 11 and 15, 1912. Rodeck, Am. Mus. Nov., No. 496, p. 1, 1931.

Cephen Robertson, Can. Ent., XXXV, pp. 174 and 176, 1903. Swenk, Nebr. Univ. Studies, XII, p. 12, 1912.

Centrias Robertson, Can. Ent., XXXV, pp. 174 and 176, 1903. Swenk, Nebr. Univ. Studies, XII, pp. 13 and 15, 1912.

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Melanomada Cockerell, Proc. Acad. Nat. Sci. Phila., p. 587, 1903. Cockerell, Proc. U. S. Nat. Mus., xxxix, p. 649, 1911. Swenk, Nebr. Univ. Studies, xii, pp 8 and 15, 1912

Nomadula Cockerell, Proc. Acad. Nat. Sci Phila., p. 611, 1903. Swenk, Nebr. Univ. Studies, xii, pp. 13 and 15, 1912. Rodeck, Am. Mus. Nov., No. 496, p. 5, 1931.

This is the largest, and perhaps the least specialized of our Nomadine genera. It may be readily known by the slender form, wasp-like appearance, six-segmented maxillary palpi, vertically projecting, flap-like, lateral processes of first abdominal tergite, shape of the fifth sternite of the female and structure of the male genitalia.

Form slender, integument finely, distinctly punctate, usually red, or black with yellow markings; vestiture sparse, not squamose.

Head: About as wide as thorax; antennae inserted well above middle of face, elongated, thirteen-segmented in male; scape more than twice as long as broad, rarely robust in male; pedicel considerably broader than long, sometimes concealed within apex of scape; flagellum with segments as long as or longer than broad; eyes at least twice as long as greatest width, inner margins not or weakly margined by carinae; labrum broader than long, apex rounded; mandibles short, rather straight, abruptly expanded basally, simple or with subapical tooth, rarely with tooth on outer margin in male; anterior basal angle of mandibles farther from eye than posterior basal angle and anterior to inner margins of eyes; maxillary palpi long, slender, six-segmented; gular groove slightly narrowed posteriorly, approximately as wide anteriorly as distance from groove to eye; area between gular groove and eyes slightly convex.

Thorax: Pronotum with dorsal lobes well developed and nearly right-angular when viewed from above, their anterior faces strongly convex, separated by about distance between tegulae; mid-dorsal portion of pronotum visible from above, not obscured by mesoscutum; mesoscutum moderately convex, about as wide as long, anterior margin strongly curved, attaining anterior margin of dorsal lobes of pronotum; anterior lateral mesoscutal processes nearly as broad as length of tegulae; tegulae broadly oval, but little longer than broad; sides of mesepisterna slightly convex, at broadly rounded right-angles to anterior faces; dorsal width of mesepisternum less than ventral width, greatest width nearly twice ventral width; subtegular plate much smaller than pronotal tubercle, separated from it by not more than one-third breadth of tubercle; axillae and mesoscutellum not on same plane as mesoscutum; axillae rounded; mesoscutellum usually strongly biconvex, posterior half usually nearly vertical; metanotum and posterior face of propodeum strongly slanting posteriorly; metanotum about one-fourth as long as mesoscutellum, without a median elevation; propodeal spiracles large, anterior to middle of propodeum, lower end slightly posterior to upper end; wings variably dusky, anterior wings with stigma large, marginal cell much longer than distance from apex to tip of wings, apex of cell subacute, not separated from costa, submarginal cell normally three, first nearly as long as second and third together, first transverse cubitus sometimes wanting, second more rarely wanting; first recurrent vein received by second submarginal cell, usually near middle; metasternum longer than broad, parallel-sided, apex obtusely or rarely acutely angulate; anterior coxae about as broad as long; middle coxae much shorter than distance from their apices to hind wing bases, or sometimes nearly as long as this distance; strigilis with apical emargination acutely angular, outer apical angle spiniform, inner apical angle acute, inner margin broadly, transparently membranous; anterior basitarsus with cavity distinctly less than half length of segment; legs slender, tibiae not distinctly spiculate on outer sides; hind tibiae expanded apically, apex with a row of coarse setae externally; posterior tarsi with first two segments nearly as long as tibiae, basitarsi as long as, or longer than, remaining segments together, more than five times as long as apical width; claws cleft at base, inner lobe broad; pulvilli about half as long as claws

Abdomen: Long, slender, segments not constricted and depressed basally or apically, posterior lateral angles of tergites broadly rounded; first tergite gradually narrowed to base, anterior face nearly horizontal, without a transverse ridge, with a longitudinal median sulcus, lateral margins not closely appressed to first sternite, but nearly always produced as transparent ventral flaps. Female: Fifth tergite not entirely concealing sixth, apical margin with a broad, transverse, densely pubescent, pseudopygidial area; sixth tergite large, elongate, well sclerotized, pygidial plate large, well defined, usually broadly triangular; fifth sternite with a narrow, median, apical emargination; sixth sternite more than twice as long as broad, exposed at apex which is broadly rounded and bears a series of large, curved spines on each side, lateral subapical lobes large, recurved over apex of sternite to form a broad open tube in which the sting lies, and produced anteriorly into a strong, acute, dorsal angle on each side, segment submembranous except for lateral and apical margins; third pair of valvulae hairy throughout, less than one-half as long as the sting. Male: Pygidial area of seventh tergite elongate, produced, well defined, base wide, apex notched or narrowly rounded; genital armature subquadrate, coxopodite with inner dorsal margin emarginate, stipites short, clothed at apex with long, plumose hairs, sagittae slender, exceeding apices of stipites, clothed with moderately long hairs, spatha elongate, covering sagittae nearly to apex.

GENOTYPE: *Apis ruficornis* Linn. (Curtis designation, 1832).

This genus is Holarctic in distribution and primarily parasitic in the nests of *Andrena*. However, in Europe some of the species are said to parasitize also *Halictus, Panurgus,* and *Eucera*. Ten subgenera, as listed above, have been proposed for the North American fauna and some of these may prove to be of generic importance. In fact Robertson (1903) treated all of the groups known to him as genera. Swenk (1913) has given the most thorough treatment of the groups, and considered *Cephen* synonymous with *Micronomada, Xanthidium* synonymous with *Heminomada.*

HEXEPEOLUS Linsley and Michener

Hexepeolus Linsley and Michener, Pan-Pac. Ent., XIII, p. 77, 1937.

This genus is related to *Nomada* but differs in the more robust form, the rounded marginal cell which is slightly separated at apex from the costal margin of wing, the pubescent-banded abdomen with the lateral lobes of the first tergite closely appressed to the first sternite, the bilobed sixth sternite of the female, with the lobes margined laterally with a comb-like row of spines, and in the structure of the male genitalia in which the stipites are clothed with short, simple hairs and the sagittae are curved downward and not covered by the spatha.

Form robust; integument finely punctate, black, that of abdomen red in female; vestiture not squamiform.

Head: Narrower than thorax; antennae inserted opposite middle of eyes, those of male thirteen-segmented, shorter than female, scape about three times as long as broad; flagellum slender, segments longer than broad in female, broader than long in male; eyes more than twice as long as greatest breadth; labrum broader than long, apex broadly rounded; mandibles simple, rather broad, feebly widened basally, outer margins not strongly curved, apices lying one above the other in repose, anterior basal angles more widely separated from eyes than posterior basal angles and in front of anterior margins of eyes; maxillary palpi long, six-segmented, basal segment short, little longer than broad; gular groove hardly narrowed posteriorly, much wider than distance from groove to eyes; area between gular groove and eyes convex.

Thorax: Short, compressed antero-posteriorly; pronotum with dorsal lobes forming an angle of about 135° when viewed from above, separated by hardly more than shortest distance between tegulae, anterior faces convex; mid-dorsal portion of posterior margin of pronotum scarcely visible from above; mesoscutum convex, more strongly so anteriorly, anterior lateral processes about one-half as broad as length of tegulae, posterior lateral angles rounded; tegulae broadly oval, but little longer than broad; mesepisterna with lateral faces strongly convex, at rounded right-angles to anterior faces; dorsal width of mesepisterna less than ventral width, greatest width one and one-half times ventral width; subtegular plate about as large as pronotal tubercle, separated from it by about one-half width of pronotal tubercles; axillae rounded; axillae and mesoscutellum sloping posteriorly, not on same plane as mesoscutum; mesoscutellum strongly biconvex; metanotum strongly convex and widened at middle, without a median elevation, length medially about one-third that of scutellum; propodeum, viewed in profile, strongly convex at basal one-third, face posterior to convexity nearly vertical; propodeal spiracle anterior to middle of propodeum, lower end anterior to upper end; wings dusky; fore wings with stigma moderately broad throughout, marginal cell elongate, much longer than distance from apex to tip of wing, apex narrowly rounded, slightly separated from costal margin, feebly appendiculate; submarginal cells normally three, second transverse cubitus often incomplete or wanting, first submarginal cell measured along posterior margin, approximately as long as second and third together; metasternum broader than long, short lateral margins subparallel, apex approximately right-angled; anterior coxae distinctly broader than long; middle coxae about two-thirds as long as distance from apices to hind wing bases; strigilis with apical emargination right-angular, outer apical angle short, spiniform, inner apical angle right-angular, inner margin broadly, transparently membranous; legs robust, tibiae not spiculate, posterior pair without an apical row of coarse setae; posterior tarsi with first three segments approximately as long as tibiae, basitarsus broad, longer than remaining segments together, about four times as long as apical width, carinate externally, with short apical tooth; anterior claws of male with an inner subapical tooth, claws of female and remaining claws of male cleft at base, inner lobe shorter and broader on posterior tarsi; pulvilli slightly more than half as long as claws, somewhat enlarged apically.

Abdomen: Short, broad, segments not constricted or depressed at bases or apices; posterior lateral angles of tergites two and three nearly right-angular, of remaining tergites rounded; first tergite broadly rounded at base, anterior face almost vertical, broadly, shallowly concave, not sulcate and without a transverse carina. Female: Fifth tergite nearly concealing sixth, with an apical, transverse, pubescent, pseudopygidial area, but little wider than apex of pygidial plate; sixth tergite large, broad, heavily sclerotized, pygidial plate broad, apex broadly rounded; fifth sternite unmodified, sixth sternite slightly longer than broad, rather evenly sclerotized throughout, apex emarginate, posterior lobes margined by comb-like rows of spines, subapical lateral lobes posteriorly curved over apex of sternite to form an open tube for sting, anteriorly produced as an acute dorsal angle; third pair of valvulae hairy except at base, slightly less than one-half as long as sting. Male: Pygidial plate of seventh tergite well defined, elongate, produced, apex narrowly rounded; genital armature subquadrate; coxopodites with dorsal margin emarginate, stipites short, clothed beneath with simple hairs, sagittae bent downward, not covered by the spatha.

GENOTYPE: *Hexepeolus mojavensis* Linsley and Michener (by original designation).

The habits of the two recognized species of *Hexepeolus* both from southern California, are unknown, but they are suspected of being parasites of *Ancylandrena* (Andrenidae).

PARANOMADA Linsley and Michener

Paranomada Linsley and Michener, Pan-Pac. Ent., XIII, p. 82, 1937. Linsley, Pan-Pac. Ent., XV, p. 11, 1939.

Paranomada may be readily distinguished from the other genera in our fauna by the indistinct coronal suture, strongly dorso-ventrally flattened thorax, polished, almost impunctate integument, large metasternum with the anterior process broad, elongate and acutely pointed, short flagellum with the intermediate segments wider than long, and the lamellate coxae of the female. The wing venation is essentially that of *Nomada*.

Form slender, dorso-ventrally compressed; integument black in male, red in remale, polished, almost impunctate; vestiture sparse except for areas of dense, velvety pubescence.

Head: Nearly as wide as thorax; antennae short, inserted opposite middle of eyes, thirteen-segmented in male, scape about three times as long as broad, flagellum with segments mostly wider than long; eyes small, about twice as long as broad, widest below middle, inner margins not bounded by carinae; labrum broader than long; mandibles slender with a very feeble inner tooth beyond the middle, outer margins not strongly curved, apices lying one above the other in repose, anterior basal angles much more widely separated from eyes than posterior angles and inserted anterior to inner margins of eyes; maxillary palpi short, four- or five-segmented, basal segment subglobular, second segment elongate, at least at long as the two following together; gular groove narrow, widened anteriorly, closed behind, separated from eyes by more than width of groove, intervening area convex.

Thorax: Pronotum with dorsal lobes prominent, nearly right-angular when viewed from above, separated by about shortest distance between tegulae, anterior faces angularly convex, posterior margin of pronotum, mid-dorsally, barely visible from above; mesoscutum weakly convex, much wider than long, anterior margin subtruncate medially, not attaining anterior margin of dorsal lobes of pronotum, anterior lateral processes, viewed from side, less than one-third as wide as length of tegulae; tegulae large, broad, campanulate; mesepisterna with lateral faces more or less convex, forming a broadly rounded, obtuse angle with anterior faces; subtegular plate much smaller than pronotal tubercle, separated from it by half the width of tubercle; axillae rounded, not produced; axillae and mesoscutellum sloping posteriorly, not on same plane as mesoscutum; mesoscutellum weakly, evenly convex; metanotum about one-third as long as mesoscutellum; metanotum and dorsal face of propodeum slanting posteriorly at angle of about 45°; propodeal spiracle large, broadly curved, at about middle of side of propodeum, the ends on a vertical line; wings short, smoky with clear areas, anterior wings with stigma moderately broad throughout, marginal cell much longer than distance from its apex to tip of wing, apex narrowly rounded, not separated from costal margin, not appendiculate, submarginal cells three, first conspicuously shorter than second and third together; metasternum large, very elongate, drawn out anteriorly into a broad, acutely pointed, triangular process within the mesosternum, produced posteriorly as a distinct, median, acutely pointed, intercoxal process, lateral margins of metasternum rounded; coxae lamellate externally in female; anterior coxae about one and one-half times as broad as long, middle coxae very widely separated, dorso-ventral length of middle coxae as great as distance from upper ends to posterior wing bases; legs robust, femora flattened; strigilis with apical emargination acutely pointed, inner apical angle acute; anterior basitarsi with concavity about one-fourth as long as basitarsi; intermediate and posterior tibiae spiculate externally, without an apical row of coarse setae; posterior tarsi with first two segments longer than tibiae, the basitarsi about as long as remaining segments and about five times as long as apical width; claws of male cleft at base; pulvilli distinctly more than one-half as long as claws.

Abdomen: Slender, posterior lateral angles of tergites rounded; first tergite gradually narrowed to base, anterior face nearly horizontal, without a transverse carina, with a longitudinal, median, basal sulcus, lateral margins closely appressed to sternite, not separated as transparent ventral lobes. Female: Fifth tergite largely concealing sixth, with a broad, transverse, densely pubescent, pseudopygidial area along posterior margin; pygidial plate large, occupying entire apical portion of sixth tergite, apex broadly truncate; sixth sternite nearly concealed by fifth, only the posterior lobes projecting, these slightly curved, bearing on inner sides a few inconspicuous spines. Male: Pygidial plate of seventh tergite well defined, elongate, produced, apex narrowly rounded, entire; genital armature moderately elongate, coxopodites convex dorsally, inner margins scarcely emarginate, stipites moderately elongate, clothed apically with simple hairs, sagittae robust, nearly straight, with a few, short hairs externally.

GENOTYPE: *Paranomada nitida* Linsley and Michener (by original designation).

Only two species of *Paranomada* are known, both from Arizona. Nothing is known of their habits or hosts.

HESPERONOMADA Linsley

Hesperonomada Linsley, Pan-Pac. Ent., xv, p. 5, 1939.

This and the following genus differ from the other Nomadine genera in the short, fewer segmented maxillary palpi, flattened antennal scape, and the structure of the fifth abdominal sternite of the female (produced posteriorly as a broad, hairy process). Superficially the type species of *Hesperonomada* resembles a *Nomada*, but in addition to the characteristics enumerated above it may be readily distinguished by the five-segmented maxillary palpi, the finely punctured integument, and the closely appressed lateral tergal processes of the first abdominal segment.

The genus, as known at present, is restricted to California.

Form slender; integument finely punctate, black, abdomen of female red; vestiture not squamiform.

Head: Narrower than thorax; antennae inserted slightly above middle of eyes, thirteen-segmented in male; scape flattened, three times as long as broad; flagellum with segments longer than broad in female, about as broad as long in male; eyes more than twice as long as greatest width, but slightly wider below than above; female with an oblique groove on each side of face from lower third of inner eye margin to sides of clypeus; labrum twice as broad as long, apex very broadly rounded; mandibles simple, slightly curved, apices lying one above the other in repose; anterior basal angles of mandibles barely farther from eyes than posterior basal angles, not inserted in front of inner ocular margins; maxillary palpi rather long, five-segmented, first segment one and one-third times as long as second, remaining segments subequal; gular groove slightly narrowed posteriorly, broader than distance to eye, intervening areas convex.

Thorax: Pronotum with dorsal lobes forming angles of about 125° when viewed from above, separated by a little less than shortest distance between tegulae, anterior faces convex; mid-dorsal posterior margin of pronotum distinctly visible from above; mesoscutum convex throughout, more so anteriorly, anterior lateral processes a little wider than one-half length of tegulae; tegulae broadly oval, a little more than one and one-half times as long as broad; mesepisterna with lateral faces strongly convex, at rounded right-angles to anterior faces; subtegular plates somewhat smaller than pronotal tubercles, and separated by less than half width of tubercle;

axillae rounded; mesoscutellum weakly biconvex; metanotum and posterior face of propodeum sloping at about 45° angle; metanotum about one-third as long as scutellum, not widened or strongly convex medially; propodeal spiracles rather large, anterior to middle of propodeum, lower end posterior to upper end; wings slightly infuscated, with darker areas apically; forewings with stigma rather large, marginal cell much longer than distance from its apex to tip of wing, apex acute, not separated from costal margin of wing; submarginal cells two, second receiving both recurrent veins and slightly longer than first measured on cubital margin; metasternum longer than broad with sides broadly rounded, anteriorly produced into mesosternum as broadly triangular process, ending in a right-angle, posteriorly produced as broad intercoxal process with rounded apex; anterior coxae broader than long; middle coxae more than two-thirds as long dorso-ventrally as distance from upper ends to hind wing bases; strigilis with apical emargination acutely angular, outer apical angle robust spiniform, inner apical angle slender and acute, inner margin broadly transparently membranous; cavity of anterior basitarsus slightly more than one-fourth as long as segment; legs rather robust; posterior tibiae spiculate externally; posterior tarsi with first two segments slightly longer than tibiae, the basitarsi about as long as remaining segments together, nearly five times as long as apical width; claws with large inner tooth, smaller in female than in male and smaller on anterior tarsi; pulvilli distinctly more than half as long as claws, swollen apically.

Abdomen: Segments not constricted at bases or apices; posterior lateral angles of tergites rounded; first tergite somewhat tapering anteriorly, with a basal longitudinal sulcus. Female: Fifth tergite not completely concealing sixth, pseudopygidial area moderate sized, about twice as broad as long; sixth tergite broad, transverse, not heavily sclerotized, pygidial plate ill defined, clothed with long hairs, apex narrowly subtruncate; fifth sternite produced at apex as a long, median process, wide at base, slender and acute at apex, clothed with long hairs; sixth sternite longer than broad, tapering distally to apex which is narrow, bilobed, the lobes bearing stout spines on inner margins, sternite weakly sclerotized except for lateral and apical margins; third pair of valvulae about one-half as long as sting, clothed throughout with very short hairs. Male: Pygidial plate of seventh tergite rather broad, produced, rounded apically; genital armature broad, coxopodites with a conspicuous inner apical lobe, inner dorsal margins scarcely emarginate, stipites long and slender, clothed beneath with moderately short, simple hairs, with a short basal lobe clothed with long, simple hairs, sagittae long, slender, but not attaining apices of stipites, clothed externally with short, simple hairs.

GENOTYPE: *Hesperonomada melanantha* Linsley (by original designation).

TRIOPASITES Linsley

Triopasites Linsley, Pan-Pac. Ent., xv, p. 8, 1939.

Triopasites is apparently related to *Hesperonomada* but differs by having three submarginal cells in the anterior wing, the marginal cell shorter, rounded at the apex and slightly separated from the costal margin of wing and the three-segmented maxillary palpi. The male is unknown, but the female bears a strong superficial resemblance to *Oreopasites*.

Only a single species has been described, occurring in southern California. Nothing is known of its hosts or habits.

Form robust; integument finely punctate, black, that of abdomen red (at least in female); vestiture sparse, not squamiform, composed in part of patches of plumose hairs.

Head: Nearly as wide as thorax; antennae inserted slightly above middle of eyes, scape somewhat flattened and fully three times as long as broad, flagellum (female) with segments about as long as broad; eyes widest below, about twice as long as greatest width; lower sides of face with a distinct oblique groove from lower third of eye to side of clypeus; labrum broader than long, apex rounded; mandibles slender, with feeble tooth on inner side beyond middle, outer margin gently curved, apices lying one above the other in repose, anterior basal angles more widely separated from eyes than posterior basal angles and scarcely anterior to inner margins of eyes; maxillary palpi short, three-segmented, first segment globular, others elongate; gular groove narrowed and nearly closed posteriorly, anteriorly wider than distance to eye; area between gular groove and eyes convex.

Thorax: Pronotum with dorsal lobes forming angles of about 135° when viewed from above, separated by slightly less than greatest distance between tegulae, anterior faces convex; posterior margin of pronotum mid-dorsally visible from above; mesoscutum convex, more strongly so anteriorly, anterior lateral processes less than half as broad as length of tegulae; tegulae broadly oval, less than one and one-half times as long as broad; mesepisterna with lateral faces strongly convex, at rounded right-angles to anterior faces; subtegular plate distinctly smaller than tubercle, separated from it by about one-half width of tubercle; axillae rounded; mesoscutellum convex, not on same plane as mesoscutum; metanotum and propodeum sloping posteriorly; metanotum widened medially, nearly one-half as long as mesoscutellum; propodeal spiracle large, at about middle of side of propodeum, lower end posterior to upper end; wings clear with darkened areas apically; stigma rather large; marginal cell much longer than distance from its apex to tip of wing, apex very narrowly rounded with a short appendage, apex of cell rather abruptly but slightly bent away from costal margin of wing; submarginal cells three, first distinctly shorter than second and third together; metasternum with short posterior intercoxal process, acutely pointed at apex; anterior coxae slightly broader than long; dorso-ventral length of middle coxae more than two-thirds as great as distance from dorsal margins to posterior wing bases; strigilis with apical emargination acutely angular, outer apical angle robust spiniform with a slight subapical notch within, inner apical angle acute, inner margin broadly transparently membranous; anterior basitarsi with cavity about one-fourth as long as basitarsus; legs robust, outer sides of intermediate and posterior tibiae spiculate; posterior tarsi with first two segments slightly shorter than tibiae, basitarsi slightly shorter than remaining segments together, more than four times as long as apical width; tarsal claws with a large basal tooth, those of intermediate and posterior legs largest and rather broad; pulvilli very slender, broadest subapically, nearly as long as claws.

Abdomen: Posterior lateral angles of tergites rounded; first tergite rounded anteriorly, with a longitudinal basal sulcus and without a transverse ridge. Female: Fifth tergite covering sixth, almost its entire dorsal exposed surface being occupied by a large, brown, hairy, pseudopygidial area which is a little more than twice as broad as long; sixth tergite concealed by fifth; fifth sternite with a broad, hairy, obtusely pointed, median, apical process, sixth sternite with exposed apex narrow, deeply emarginate at middle, posterior lobes with two or three heavy spines internally before apex, lobes with a few hairs basally on inner and outer margins.

GENOTYPE: *Triopasites timberlakei* Linsley (by original designation).

Tribe EPEOLOIDINI

This tribe contains the single, Holarctic genus, *Epeoloides*.

The following combination of characters distinguishes it from the other tribes of the Nomadidae: Vestiture heavily plumose, maxillary palpi composed of four free segments, pterostigma short, broad, marginal cell broadly rounded or subtruncate at apex, three submarginal cells of subequal length, pygidial plate present in both sexes, pseudopygidial area absent, sixth abdominal tergite of female exposed, sixth sternite boat-shaped, extending beyond apex of sixth tergite, and the structure of the male genitalia. The tribe is isolated and cannot be satisfactorily placed in a linear arrangement to show its relationships. Popov (in litt.) suggests a relationship with the Neopasitini.

EPEOLOIDES Giraud

Epeoloides Giraud, Verh. Zool. bot. Ges. Wien, xiii, p. 45, 1863. Gerstaecker, Stett. Ent. Zeit., xxx, p. 161, 1869. Radoszkowski, Bull. Soc. Nat. Moscou, xlv, p. 4, 1872. Taschenberg, Berl. ent. Zeitschr., xxvii, p. 68, 1883. Friese, Bien. Eur., i, p. 211, 1895. Frey-Gessner, Faun. Ins. Helv., Hymen. Apid., i, p. 157, 1899. Ashmead, Trans. Am. Ent. Soc., xxvi, p. 68, 1899. Schmiedeknecht, Hymen. Mitteleur., p. 146, 1907. Ducke, Zool. Jahrb., Abt. f. Syst., lxxxiv, p 71, 1912. Crawford, Proc. Ent. Soc. Wash., xix, p. 167, 1917. Friese, Die eur. Bienen, p. 406, 1923. Friese, Ins. Mitteleur., i, p. 110, 1925. Grütte, Arch. f. Naturgesch., iv, p. 516, 1935.

Viereckella Swenk, Ent. News, xviii, p. 298, 1907. Cockerell, Proc. U. S. Nat. Mus., xxxix, p. 649, 1911. Swenk, Nebr. Univ. Studies, xii, p. 13, 1912. Viereck, Conn Geol. Nat. Hist. Surv., Bull. no. 22, p. 722, 1916.

Epeoloides looks like a robust, black or partly black *Nomada*, but may be readily distinguished from that genus by the heavily plumose pubescence, the form of the marginal cell and pterostigma, the shape of the pygidium and the strongly dorsally converging eyes in the male, as well as by the form of the sixth sternite in the female, and the short, four-segmented maxillary palpi.

The genus is represented in North America by two species, presumably parasitic in the nests of *Macropis* (Macropidae) as is the European species.

Form robust; integument finely punctate, black, that of abdomen sometimes red in female; vestiture not squamiform, mostly long and very plumose.

Head: Distinctly narrower than thorax; antennae inserted very slightly below middle of eyes, thirteen-segmented in male, scape three times as long as broad, flagellum with segments longer than wide in female, wider than long in male; eyes of male three times as long as broad, parallel-sided medially, of female two and one-half times as long as broad, broadest below; inner margins of eyes bounded by a carina extending to side of clypeus, those of male strongly converging toward vertex, of female subparallel; eyes separated from lateral ocelli in male by less than one ocellar diameter, in female by three ocellar diameters; ocelli large, separated from one another by at least one-half an ocellar diameter; anterior angle of ocellar triangle right-angular; labrum short, not attaining mandibles in repose, more than twice as broad as long, widest at apex, which is shallowly emarginate; mandibles moderately curved with an inner subapical tooth, apices scarcely crossing over in repose, anterior basal angles about as far from eyes as posterior basal angles and not anterior to inner margins of eyes; maxillary palpi short, with four free segments; gular groove with sides subparallel, broader than distance to eyes, interval convex and clothed with very long, erect, plumose hairs.

Thorax: Pronotum with dorsal lobes forming angles of about 135° as viewed from above, further apart than tegulae, anterior faces convex; posterior margin of pronotum mid-dorsally scarcely visible from above; pronotal tubercles small; mesoscutum strongly convex, anterior lateral processes more than half as wide as length of tegulae; tegulae broadly oval, less than one and one-half times as long as broad; mesepisterna with outer faces strongly convex, dorsal width greater than ventral width, greatest width at least twice ventral width, at broadly rounded, slightly obtuse angle to anterior faces; subtegular plate smaller than pronotal tubercle, separated from it by about two-thirds width of tubercle; axillae rounded; mesoscutellum strongly convex with a feeble, longitudinal, median impression; metanotum, viewed in profile, subvertical, more than one-third length of mesoscutellum, not widened medially; propodeum with posterior face evenly but not strongly convex, anterior part distinctly less vertical than metanotum; propodeal spiracle small, anterior to middle of propodeum, lower end posterior to upper end; wings infuscated, apical margin beyond venation more strongly, closely sculptured than elsewhere; forewings with stigma short and broad, marginal cell about as long as distance from apex to tip of wing, apex broadly rounded, bent away from costal margin, or almost obliquely truncate; submarginal cells three, first much shorter than second and third together; first recurrent received by second submarginal cell near apex; mesosternum short; metasternum broader than long, with a short, narrow, acutely pointed process extending foreward into mesosternum, sides of metasternum emarginate, slightly, acutely produced anteriorly, broadly rounded posteriorly, apex produced as broad, subtriangular, intercoxal process; front coxae flattened, slightly longer than broad viewed from front; middle coxae with dorso-ventral length greater than distance from upper margin to hind wing bases; strigilis with apical emargination shallow, acutely angular, outer apical angle elongate and very robust, subspiniform, inner apical angle small and acute, inner margin transparent; cavity of anterior basitarsi semicircular, about one-fifth as long as segments; legs robust, femora and tibiae, especially in male, swollen, tibiae not spiculate, posterior pair in female with scattered, deep, coarse punctures; posterior basitarsi about as long as tibia in male, shorter in female, distinctly longer than remaining tarsal segments in male, as long as remaining tarsal segments in female, four to five times as long as apical width; claws incompletely bifid in male, cleft at base in female with inner ramus rather slender, about half as long as outer ramus, pulvilli less than one-half as long as claws, swollen apically.

Abdomen: Robust, segments not constricted basally and apically; posterior lateral angles of tergites rounded; first tergite rounded basally, anterior face subvertical with a short, broad, deep, longitudinal, basal sulcus. Female: Fifth tergite without a pseudopygidial area; sixth tergite partially covered by fifth, elongate, heavily sclerotized, pygidial area broadly triangular, apex narrowly subtruncate; fifth sternite unmodified; sixth sternite nearly three times as long as broad, apex narrowly rounded with a few hairs, lateral apices recurved dorsally to form a tube in which the sting lies, sternite membranous except for apex, apex extending well beyond tip of sixth tergite; sting very long, third pair of valvulae elongate, slender, less than one-half as long as sting, apical one-half hairy. Male: Pygidial plate of seventh tergite small, slanting posteriorly, elongate spatulate, constricted at base, apex produced beyond apex of tergite; genital armature broad, stipites not differentiated from coxopodites, coxopodites with a well developed inner dorsal lobe, with apices flattened, bent downward, clothed with long, simple hairs, sagittae far exceeding apices of coxopodites, with a few very short hairs externally.

GENOTYPE: *Epeoloides ambigua* Giraud (=*Apis coecutiens* Fabricius).

Tribe EPEOLINI

The distinctive characters of this tribe are the squamiform vestiture, the very short, one- or two-segmented maxillary palpi, the low antennal insertions, the rounded marginal cell which is separated from the costal margin of the wing at the apex, the acutely produced axillae, the presence of a pygidial plate in both sexes and of a more or less distinct pseudopygidial area in the female, and the short pulvilli.

The tribe includes *Epeolus* and *Triepeolus,* and very likely the South American genus *Thalestria* (which we have not been able to study).

EPEOLUS Latreille

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Pyrrhomelecta Ashmead, Trans. Am. Ent. Soc., XXVI, p. 66, 1899.

Argyroselenis Robertson, Can. Ent., XXXV, p. 284, 1903.

Form robust; integument largely black, usually finely punctate; vestiture prostrate, with patches of squamiform hairs.

Head: As wide as thorax; antennae usually inserted slightly below middle of eyes, thirteen-segmented in male, scape twice as long as broad, flagellum with segments longer than wide in female, wider than long in male; eyes more than twice as long as greatest width, slightly wider below, inner margins strongly converging toward clypeus and each bounded by a carina which extends along sides of clypeus; labrum broader than long, apex broadly rounded, often with small apical emargination; mandibles weakly curved, simple or with subapical inner teeth, short, bases broad, apices lying one above the other in repose, anterior basal angles as close to eyes as posterior basal angles and posterior to inner margins of eyes; maxillary palpi short, composed of one or rarely two free segments on a basal tubercle; gular groove short and broad, parallel-sided, much wider than distance to eyes, interval slightly concave; cheeks each margined posteriorly by a distinct carina.

Thorax: Pronotum with dorsal lobes obsolete, collar entirely visible from above; mesoscutum convex, more strongly so anteriorly, anterior lateral processes about as broad as length of tegulae; tegulae large, oval; mesepisterna with lateral faces convex, short, dorsal width less than ventral width, greatest width about one and one-half times ventral width, at narrowly rounded right-angles to anterior faces; subtegular plate smaller than pronotal tubercle, separated by less than half width of tubercle; axillae produced, usually acutely; mesoscutellum strongly biconvex; metanotum vertical, about one-third width of scutellum; posterior face of propodeum subvertical, anterior part often less vertical than metanotum, spiracle large, slightly posterior to middle of propodeum, ventral and dorsal ends on a vertical line; wings usually infuscated, at least apically; anterior wings with apical margin more densely punctate and pubescent, stigma short and rather small, marginal cell usually shorter than distance from apex to tip of wing, apex rounded, bent away from costa, more or less obliquely truncate, submarginal cells normally three, sometimes two, first not much shorter than remaining together; metasternum about as broad as long, produced into mesosternum as a broad angle, sides subangulate, posterior end scarcely produced between coxae, apex feebly bilobed; anterior coxae broader than long, quadrangular, trochanters attached laterally; dorsal-ventral length of middle coxae about two-thirds distance from their upper margins to hind wing bases; strigilis with apical emargination right-angular, outer apical angle spiniform, inner apical angle acute, inner margin transparently membranous; cavity of anterior basitarsus about one-third length of segment; intermediate and posterior tibiae spiculate; posterior basitarsi distinctly longer than following segments together, four to five times as long as apical width; claws cleft at base, inner ramus short and often broad; pulvilli slender, over one-half as long as claws and slightly enlarged apically.

Abdomen: Short, robust; segments not constricted at bases and apices; posterior lateral angles of tergites rounded; first tergite rounded, anterior face subvertical. Female: Fifth tergite usually covering sixth in repose, posterior margin with transverse, slightly beveled, silvery area; sixth tergite broad, heavily sclerotized, pygidial area distinct, rather broad; fifth sternite large; sixth sternite broader than long, concealed except for apical processes, which are convergent, weakly toothed and rather heavily sclerotized, and whose outer margins at their bases are produced dorsally on each side as a small, acute lobe, sternite membranous except for apical processes, narrow apical margin, and lateral margins; sting long, but third valvulae rather short, hairy, one-third to one-half as long as sting. Male: Pygidial area elongate, sides subparallel, apex broadly rounded; Genital armature rather broad, coxopodites widely diverging apically, with a broad apical ventral lobe, inner dorsal margin nearly straight, stipites clothed beneath with long, simple hairs, sagittae robust, exceeding stipites, apices turned downward as spiniform processes, separated by a deep emargination from a downward projecting subapical process, spatha large, exceeding sagittae.

TRIEPEOLUS Robertson

Triepeolus Robertson, Can. Ent., XXXIII, p. 231, 1901. Robertson, Can. Ent., XXXV, p. 284, 1903. Cockerell and Robbins, Univ. Colo. Studies, VII, pp. 183 and 193, 1910. Viereck, Conn. Geol. Nat. Hist. Surv., Bull. no. 22, pp. 722, 1916. Bischoff, Deutsch. ent. Zeitschr., p. 1, 1930. Hedicke, Tierwelt Mitteleur., V, p. 155, 1930. [As subgenus.] . Grutte, Arch. f. Naturgesch., IV, pp. 493-507, 1935. Linsley, Pan-Pac. Ent., XV, p. 2, 1939.

Synepeolus Cockerell, Am. Mus. Nov., No. 23, p. 6, 1921.

This genus is closely related to the preceding, but the species are usually larger and differ in the more elongate marginal cell, usually two free segments in the maxillary palpi, and in the form of the apical abdominal tergites and sternites of the female.

The genus occurs in both North and South America and is particularly well represented in the arid southwestern United States and northern Mexico, where at least some of the species are parasitic in the nests of *Melissodes* (Anthophoridae). Bischoff (1930) has referred two Palearctic species, *Epeolus tristis* Smith, and *E. tsushimensis* Cockerell, to *Triepeolus*, but these may not be strictly congeneric. We have not seen the subgenus *Synepeolus* Cockerell which differs in having two submarginal cells in the anterior wing.

Form robust; integument mostly black, finely punctate; vestiture prostrate, dominantly squamiform.

Head: Nearly as wide as thorax; antennae inserted at or above level of middle of eyes, flagellum with segments longer than broad in both sexes; eyes approximately twice as long as greatest width, slightly wider below, inner margins converging toward clypeus, inner margins bounded by a carina extending along side of clypeus; labrum wider than long, apex broadly rounded; mandibles feebly curved, simple, bases broad, apices lying one above the other in repose, anterior and posterior basal angles equally close to eye, the former inserted behind inner margin of eye; maxillary palpi short, usually with two, rarely with one, free segments attached on a tubercle; gular groove short, broad, wider than distance to eye, interval slightly concave; cheeks margined posteriorly by a carina.

Thorax: Pronotum with dorsal lobes obsolete, collar entirely visible from above; mesoscutum convex, more strongly so anteriorly, anterior lateral processes about as wide as length of tegulae; tegulae large, oval; mesepisterna with lateral faces convex, short, dorsal width less than ventral width, greatest width about one and one-half times ventral width, at narrowly rounded right-angles to anterior faces; subtegular plate smaller than pronotal tubercle, intervening space less than one-half width of tubercle; axillae acutely produced; mesoscutellum strongly biconvex; metanotum vertical, about one third as wide as mesoscutellum; propodeum with posterior face subvertical, anterior face less vertical than metanotum, spiracle large, slightly posterior to middle of side of propodeum, ventral end directly below dorsal end; wings usually slightly infuscated, at least apically; anterior wings with apical margin more densely papillate and pubescent, stigma short, small, marginal cell as long as or longer than distance from apex to tip of wing, apex rounded, separated from costal margin, somewhat obliquely truncate, submarginal cells three, first nearly as large as second and third together; metasternum about as wide as long, produced into mesosternum as a broad angle, sides subangulate, posterior angle scarcely produced between coxae, apex feebly bilobed; anterior coxae wider than long, quadrangular, trochanters attached laterally; intermediate coxae with dorso-ventral length about two-thirds as long as distance from their dorsal ends to posterior wing bases; strigilis with apical emargination right-angular, outer apical angle spiniform, inner apical angle acute, inner margin transparently membranous; anterior basitarsi with cavity about one-fourth as long as segments; intermediate and posterior tibiae spiculate; posterior basitarsi distinctly longer than following segments together, four or five times as long as apical width; claws cleft at base, inner ramus short, broad; pulvilli slender, more than one-half as long as claws, apex slightly enlarged.

Abdomen: Short, robust, segments not constricted at bases or apices; tergites with posterior lateral angles rounded; first tergite rounded anteriorly, anterior face subvertical. Female: Fifth tergite usually covering sixth in repose, pseudopygidial area usually more than one-half as long as broad, large, sloping posteriorly, clothed with coarse, dark, erect hairs; pygidial plate of sixth tergite usually slender, apically subparallel-sided; sixth sternite much longer than broad, apical processes very long, hairy, subparallel, armed at tips with spines, and each bearing at base a small, acutely pointed dorsal lobe which articulates with seventh tergite, bases connected by a narrow, transverse rod, the remnant of the disk of the sternite; third pair of valvulae at most one-half as long as sting. Male: Pygidial plate of seventh tergite broad, apex broadly rounded; genital armature rather broad, coxopodites widely diverging apically, with a broad, apical, ventral lobe, inner dorsal margins nearly straight, stipites clothed beneath with long, simple hairs, sagittae robust, exceeding stipites, apices bent downward as spiniform processes separated by an emargination from the downward projecting subapical processes, spatha large, exceeding sagittae in length.

GENOTYPE: *Epeolus concavus* Cresson (by original designation).

Tribe PROTEPEOLINI

In this tribe the maxillary palpi are short and from one- to three-segmented, the anterior wings contain three submarginal cells of subequal length, the marginal cell is rounded and separated from the costal margin of the wing, the pulvilli are long and capitate, the axillae are rounded, and a pygidial plate is lacking in both sexes but replaced in the female by a narrow, flat, median, apical process on the sixth abdominal tergite, on each side of which stands a row of spines.

Apparently the tribe, in addition to *Protepeolus*, contains also *Isepeolus*, a neotropical genus of which we have no authentically determined specimens for comparison. For this reason, although we would have preferred basing the tribal name on the older genus, we have felt it best to select *Protepeolus* as the type.

PROTEPEOLUS Linsley and Michener

Protepeolus Linsley and Michener, Pan-Pac. Ent., XIII, p. 75, 1937. Linsley, Pan-Pac. Ent., XV, p. 5, 1939.

Protepeolus is apparently related to the South American *Isepeolus,* but may be distinguished by the three-segmented maxillary palpi and the position of the second recurrent vein. The wing structure is strongly suggestive of *Epeoloides* but the basal vein is distad to the transverse medius, the cubital vein is nearly straight and the first recurrent nervure is nearly interstitial with the second transverse cubitus.

Form robust; integument black, finely punctate; vestiture of head, thorax, legs and underside of abdomen long, erect, hairs of dorsum of abdomen prostrate, subsquamiform.

Head: Narrower than thorax; antennae inserted barely above middle of eyes; scape slender, about four times as long as broad, flagellum of male with segments broader than long; eyes two and one-half times as long as greatest width, inner margins converging toward clypeus (male), separated from lateral ocelli by about one and one-half ocellar diameters; ocelli large (male), separated from one another by about one-third of an ocellar diameter, anterior angle of ocellar triangle obtuse; labrum more than twice as wide as long, apex broadly subtruncate; mandibles strongly curved, short, with a subapical inner tooth, anterior and posterior basal angles equally close to eyes, anterior angle not in front of anterior margin of eyes; maxillary palpi short, composed of three free segments attached to a basal tubercle; gular groove broad, subparallel-sided, wider than distance to eye, interval convex.

Thorax: Pronotum with dorsal lobes and collar obsolete, tubercles forming the most elevated points of pronotum; mesoscutum strongly convex, anterior lateral processes narrower than length of tegulae; tegulae broadly oval, more than one and one-half times as long as broad; mesepisterna with lateral faces convex, broadly rounded to anterior faces, dorsal width much less than ventral width, greatest width less than one and one-half times ventral width; subtegular plates about as large as tubercle, separated by half width of tubercle; axillae not produced; mesoscutellum feebly biconvex; metanotum not widened at middle, about one-third as long as mesoscutellum, at a little more than a 45° angle from vertical; propodeum with posterior face distinctly convex, anterior face less vertical than metanotum, propodeal spiracle anterior to middle of propodeum, slender, lower end posterior to upper end; wings lightly infuscated, stigma small, short; marginal cell shorter than distance from its apex to tip of wing, apex slightly attenuated, narrowly rounded, separated from costal margin; submarginal cells three, of equal length along posterior margins, first recurrent nearly interstitial with second transverse cubitus; metasternum broader than long, four-sided, diamond-shaped, with a longitudinal median keel, and produced as a small, narrow acutely pointed process into mesosternum, and produced posteriorly as a weak, broad, intercoxal process; anterior coxae slightly longer than broad, trochanters attached apically; middle coxae with dorso-ventral width about three-fourths distance from upper margin to posterior wing bases; strigilis with apical emargination right-angular, outer apical angle slender, spiniform, inner apical angle right-angular, inner margin transparently membranous; cavity of anterior basitarsi less than one-fourth length of segment; intermediate and posterior legs robust, posterior tibiae not spiculate, expanded at apices (in male); posterior tarsi with first two segments as long as tibiae, basitarsus shorter than remaining segments together, nearly five times as long as apical width; claws of male with anterior pair incompletely bifid, the inner ramus shorter and more slender than outer ramus, middle and posterior pair cleft at base, inner ramus short; pulvilli longer than claws, swollen apically.

Abdomen: Moderately slender, posterior lateral angles of tergites broadly rounded; first tergite rounded anteriorly, with a short, broad median sulcus, anterior face subvertical. Female: Fifth tergite emarginate posteriorly, emargination bordered by a depressed shiny area, in front of which is a convex region of dense, short, erect, black hairs; sixth tergite partially concealed by fifth, exposed position heavily sclerotized, with a slender, median, parallel-sided, apical projection, on each side of which lies a series of long spines; sixth sternite tapering apically, margins near apex curved dorsally to form a tube for the sting, apex with a few hairs; sting very long. Male: Seventh tergite very feebly bilobed at apex, without a pygidial plate; genital armature long, slender, stipites not differentiated from coxopodites, coxopodites with apices bent inward, armed with coarse bristles at tip, sagittae narrow, tapering, not attaining apices of coxopodites, clothed with short hairs externally.

GENOTYPE: *Protepeolus singularis* Linsley and Michener (by original designation).

Two species of *Protepeolus* have been described, one from New Mexico, the other from Arizona, and we have seen a specimen from Lower California. Nothing is known of their habits or hosts.

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EXPLANATION OF FIGURES

PLATE XV

Sixth sternites of females:

Hexepeolus mojavensis Linsley and Michener. *Nomada* (*Holonomada*) sp. *Hesperonomada melanantha* Linsley. *Gnathopasites fulviventris* (Cresson). *Neopasites illinoiensis* (Robertson). *Epeoloides pilosula* (Cresson). *Townsendiella californica* Michener. *Neolarra* sp. *Oreopasites* sp. *Epeolus* sp. *Triepeolus concavus* (Cresson).

PLATE XVI

Seventh sternites of males:

Hexepeolus mojavensis Linsley and Michener. *Nomada* (*Holonomada*) sp. *Hesperonomada melanantha* Linsley. *Townsendiella californica* Michener. *Triepeolus* sp. *Oreopasites* sp. *Gnathopasites fulviventris* (Cresson). *Neolarra* sp. *Epeoloides pilosula* (Cresson). *Neopasites illinoiensis* (Robertson).

Eighth sternites of males:

Hesperonomada melanantha Linsley. *Nomada crotchii* Cresson. *Hexepeolus mojavensis* Linsley and Michener. *Triepeolus* sp. *Neopasites illinoiensis* (Robertson). *Nomada* (*Holonomada*) sp. *Gnathopasites fulviventris* (Cresson). *Oreopasites* sp.

PLATE XVII

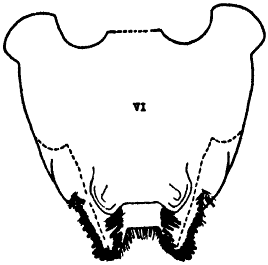
Male genital armature:

Epeoloides pilosula (Cresson). *Triepeolus* sp. *Protepeolus integer* Linsley. *Neolarra* sp. *Townsendiella californica* Michener. *Neopasites illinoiensis* (Robertson). *Hesperonomada melanantha* Linsley. *Gnathopasites fulviventris* (Cresson). *Oreopasites* sp. *Hexepeolus mojavensis* Linsley and Michener. *Nomada* (*Holonomada*) sp. *Paranomada velutina* Linsley.

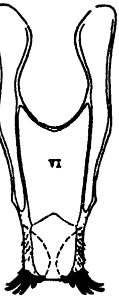
PLATE XVIII

Anterior wing:

Nomada (*Holonomada*) sp. *Hexepeolus mojavensis* Linsley and Michener. *Triepeolus concavus* (Cresson). *Epeoloides pilosula* (Cresson). *Gnathopasites fulviventris* (Cresson). *Neopasites illinoiensis* (Robertson). *Oreopasites* sp. *Neolarra* sp. *Townsendiella californica* Michener.



HEXEPEOLUS



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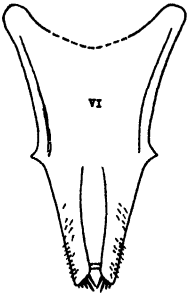
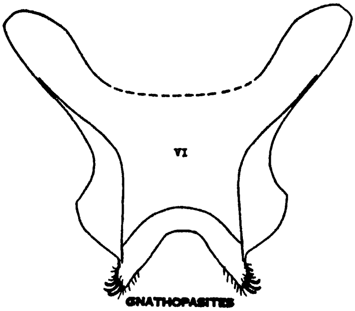
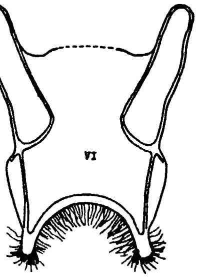


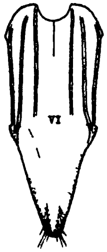
HESPERONOMADA



GNATHOPASITES



NEOPASITES



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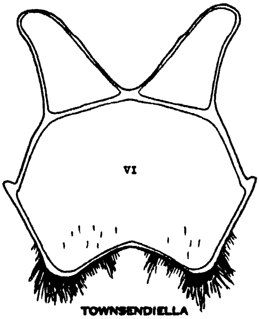

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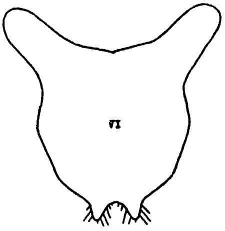

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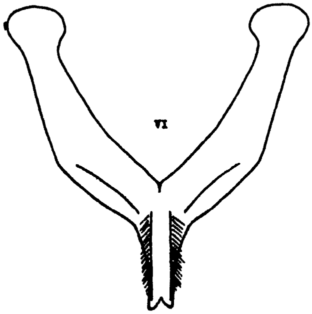
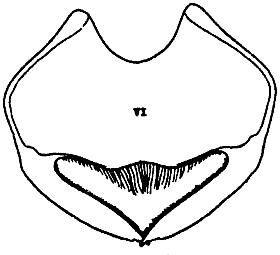
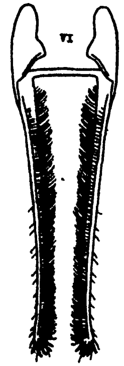


OREOPASITES

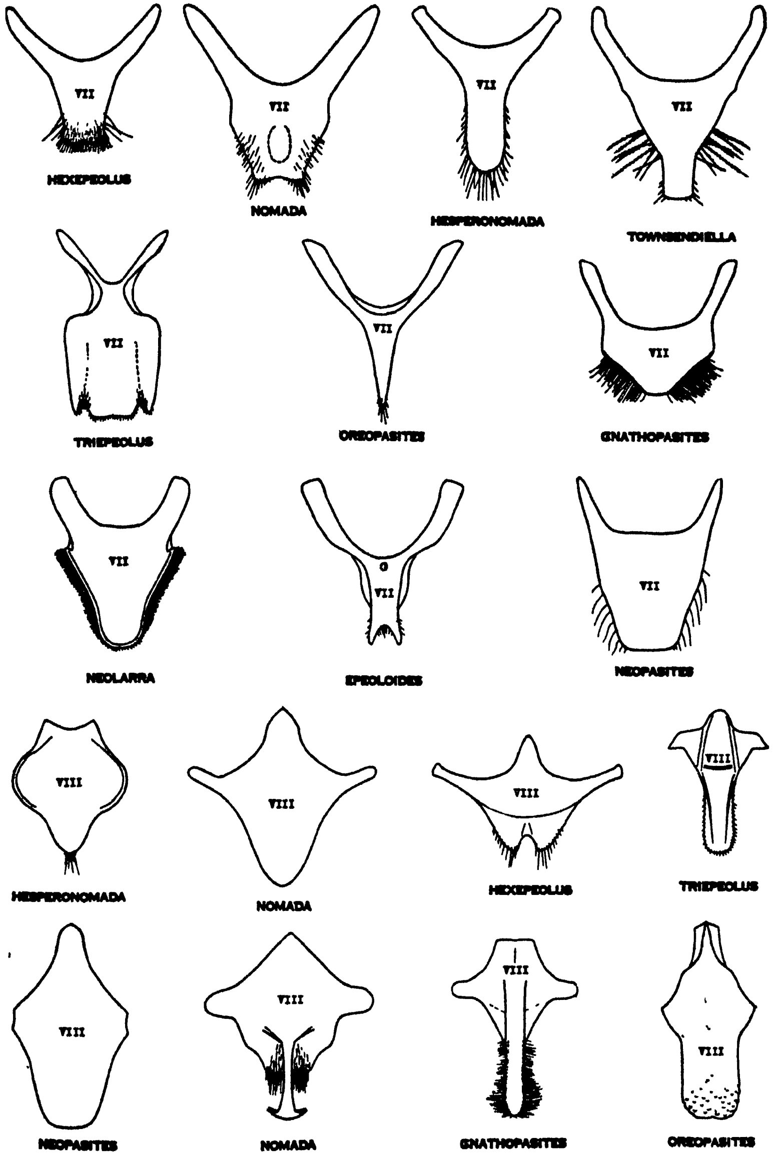


EPEOLUS



TRIEPEOLUS

LINSLEY AND MICHENER—NOMADIDAE



HEXEPEOLUS NOMADA HESPERONOMADA TOWNSENDIELLA

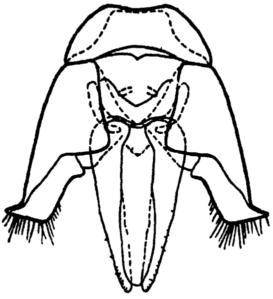
TRIEPEOLUS OREOPASITES GNATHOPASITES

NEOLARRA EPEOLOIDES NEOPASITES

HESPERONOMADA NOMADA HEXEPEOLUS TRIEPEOLUS

NEOPASITES NOMADA GNATHOPASITES OREOPASITES

LINSLEY AND MICHENER—NOMADIDAE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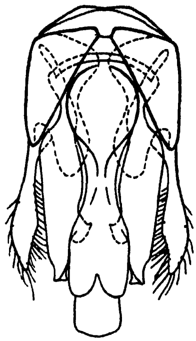
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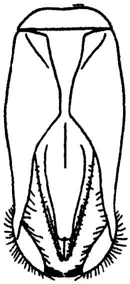
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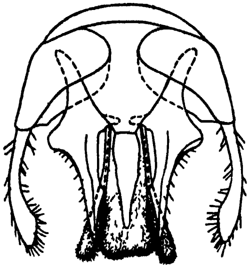
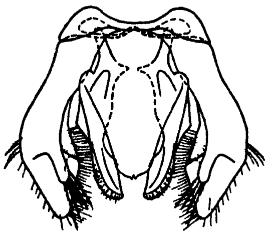

NEOLARRA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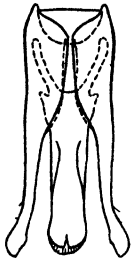
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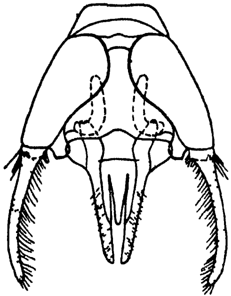
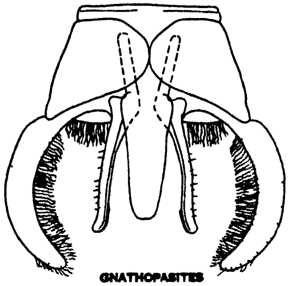

HESPERONOMADA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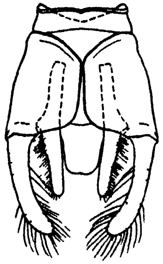
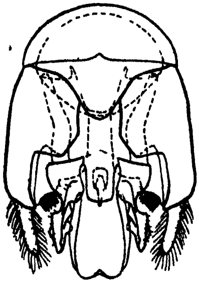
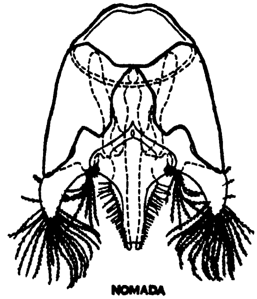
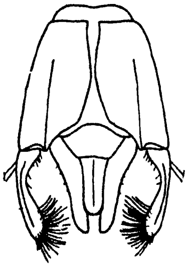
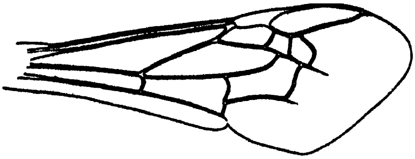

OREOPASITES


HEXEPEOLUS


NOMADA


PARANOMADA

LINSLEY AND MICHENER—NOMADIDAE



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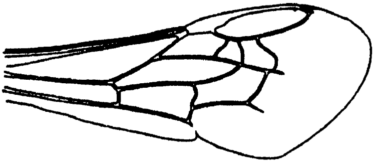
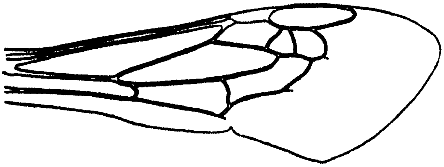
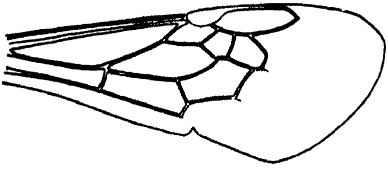


HEXEPEOLUS



TRIEPEOLUS



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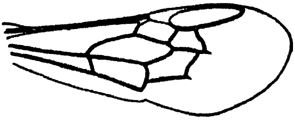

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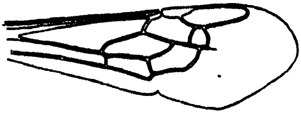

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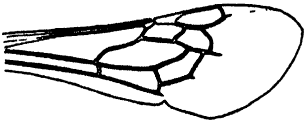
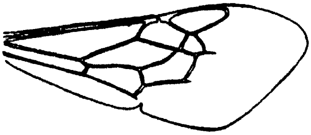
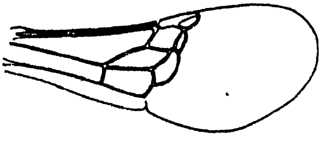


OREOPASITES



TOWNSENDIELLA



NEOLARRA

LINSLEY AND MICHENER—NOMADIDAE

A SYNOPTICAL REVISION OF THE TRIBE TROGINI ASHMEAD OF THE UNITED STATES AND CANADA

(HYMENOPTERA: ICHNEUMONIDAE)

BY H. PEARSON HOPPER
Philadelphia, Pennsylvania

(Plate XIX)

The present study was undertaken at the suggestion of Mr. R. A. Cushman of the United States National Museum. No pretensions of monographic scope are made, nor can this be considered the last word in the taxonomy of the group. The purpose of the paper is to provide a better means of identifying the species of this rather small and rare group together with a somewhat better classification. In pursuance of this idea the synonymy makes no attempt at bibliographic completeness and is restricted to those references having taxonomic or nomenclatorial importance.

Mr. Cushman's assistance has been invaluable in many ways throughout the preparation of this paper. Other individuals who have been of particular assistance are Mr. E. T. Cresson, Jr. of the Academy of Natural Sciences of Philadelphia and Mr. H. K. Townes, Jr. of the Department of Entomology of Cornell University.

Material studied was received from the following institutions (the collections of the National Museum and the Academy of Natural Sciences of Philadelphia being much larger than any of the others) after the name of each of which is given the abbreviation employed in the lists of localities: United States National Museum (US); Academy of Natural Sciences of Philadelphia and American Entomological Society (ANS); Boston Society of Natural History (BS); University of Kansas (Kans); Illinois State Natural History Survey (Ill); Entomological Division, Department of Agriculture, Canada (Can); California Academy of Sciences (Cal); and Oregon State College (Ore). Mr. Townes also furnished me with a list of localities from specimens in his collection (Tow.), in the Cornell University Collection determined by him (Tow. CU), in the collection of R. R. Dreisbach (Tow. Dreisbach), and in the Ohio State Collection determined by Mr. Townes (Tow. Ohio). One specimen determined by the author is in the collection of Mr. H. H. Swift, and specimens in the author's collection are indicated by the abbreviation (HPH). Records from check lists have not been included, except host records from the Connecticut, New York, and New Jersey (1910) lists.

While credit for much of what may be good in this paper belongs to those who have helped in one way or another, responsibility for all defects rests with the author alone. Keys throughout are of the artificial type.

DRAWINGS.—The drawings were made by the author, freehand, and for the most part without mechanical aids, and are accordingly defective in minor details, but are believed to be sufficiently accurate in the features which they are intended to show. Measurements and scales are not given, for they are not of much importance; but drawings of the same part are approximately to the same scale.

TERMS.—The majority of the terms here used will be found in Comstock's Introduction to Entomology or in De La Torre-Bueno's or Smith's Glossary of Entomology; but for clearness the following terms are discussed here: *buccate*: cheeks and temples convex or inflated, as in figure 3. *subalar callus*: the strong horizontal ridge at upper edge of mesopleurum beneath base of forewing. *tergum*: tergite as generally used. I have preferred to follow the usage of most American workers, who use the definition of Snodgrass[1] according to which the entire dorsal plate of an abdominal segment is called a *tergum* (plural *terga*). *sternum*: the entire ventral plate of an abdominal segment (compare *tergum*). Sternite of most authors. *hypopygium*: the last visible sternum in both sexes—subgenital plate of some authors, also called *hypandrium* in the male by some. *claspers*: the gonoforcipes. For the explanation of the latter term and of the other male genital structures see the admirable paper of Peck.[2] They may be identified as shell-like paired appendages at the apex of the abdomen, much larger than the only other paired abdominal appendages (except some usually concealed by the claspers) the socii or pygopods, which are cylindrical.

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[1] "Morphology of the Insect Abdomen", part I, *Smithsonian Misc. Coll.*, LXXXV, no. 6. 1931.

The following should also be noted: the numbering of the abdominal segments follows the traditional method whereby the morphological first segment, the propodeum, is not counted, the morphological second segment being called the first.—In speaking of the margination of the scutel, only that on the elevated part is referred to, the free portion of the carina not being taken into account.—Sculpture is not mentioned except in the description of new species and in some cases in the generic descriptions because no good differences could be found between species in this respect. —In comparisons between the length and breadth of a segment or joint the length and greatest width visible when viewed perpendicularly and with the adjacent parts in their normal position are to be understood.

Subfamily ICHNEUMONINAE

Tribe TROGINI

1868. *Trogoidae* Foerster, Verh. naturh. Ver. preuss. Rheinl., xxv, pp. 144, 188. (Family 27.)
1894. *Trogini* Ashmead, Proc. Ent. Soc. Wash., III, p. 278. (Tribe 1.)
1897. *Trogini* Davis, Trans. Amer. Ent. Soc., XXIV, p. 197. (Tribe.)
1898. *Joppinen*[8] Kriechbaumer, Berl. Ent. Zeitschr., XLIII, p. 1. (Subfamily.)

[8] Usually quoted by subsequent authors as *Joppinae*, but the Latin form does not appear.

1898. *Joppinae* Kriechbaumer, Ent. Nachr., XXIV, p. 2. (Subfamily.)
1900. *Joppini* Ashmead, Smith's *Insects of New Jersey* (1899), p. 563. (Tribe 1.)
1900. *Joppini* Ashmead, Proc. U. S. Nat. Mus., XXIII, p. 12. (Classification of the ichneumon-flies.) (Tribe 1.)
1904. *Joppini* Berthoumieu, Wytsman's Genera Insectorum, fasc. 18, p. 5. (Tribe 1.)
1915. *Joppides* Morley, Rev. Ichn. B. M., IV, p. 3. (Tribe.)
1934. *Trogini* Heinrich, Mitt. Zool. Mus. Berlin, XX, p. 66. (Tribe.)

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[2] *Canadian Journal of Research*, section D, XV, pp. 221-274. 1937.

First separated by Dr. Arnold Förster as his family Trogoidae, consisting of the genera *Trogus*, *Dinotomus*, and *Automalus*, and based on the elevated and conical scutel, the present group was first treated as a tribe by Ashmead in 1894. Davis, in his monograph of the Tryphoninae, gave a synopsis of the tribes of Ichneumonidae which is little more than a translation of Förster's key to families with the tribal ending substituted. Then in 1898 Kriechbaumer monographed the tribe, treating it as a subfamily, totally omitting the genus *Trogus* and arbitrarily changing the name *Joppa* (on which he nevertheless founded the subfamily name) to *Microjoppa*, and including a host of genera, mostly new, resembling each other in most cases only in the elevation of the scutel, which we now know to occur in many quite distantly related groups of genera. Ashmead then adopted Kriechbaumer's concept of the group as well as his name, in his two subsequent publications, merely altering the name to the tribal form, restoring the genus *Trogus* (with which he considered *Tricyphus* to be a synonym), using *Joppa* instead of *Microjoppa*, and adding a few other genera which he considered to belong to the group, making the definition of the tribe still more vague by partially eliminating the character of the elevated scutel without substituting anything definite for it. Berthoumieu for the most part followed Ashmead, as did Morley except in the form of the name, neither of them adding anything of importance. One might really say that no real advance was made in the study of these insects from the time of the first inchoative separation of the group as a family by Förster up to the year 1934, all workers in the interim having merely added new genera, mostly related only by the superficial character of the elevated scutel. However, in the year mentioned, Gerd Heinrich, in the introduction to his monumental Ichneumoninae von Celebes, gave a key to the tribes of the subfamily which, although evidently not considered complete by its author, represents a tremendous stride forward over the rather superficial classification of Forster, Kriechbaumer, and Ashmead.

Description of the Tribe Trogini.—The following description is based on the nearctic genera, including the genotypes of all save *Tricyphus*.

Size usually large, occasionally moderate (from 14 mm. to over 30 mm., most species ranging from 18 to 25 mm.).

Antennae long and slender, in the male with a ridge on the inner side of flagellar joints, giving a serrate appearance, and in the female of most genera (all ours except *Trogus*) the apical third or more is flattened beneath and broadened ("lanceolate"). Head moderate to large, from slightly narrower to slightly broader than thorax; occiput margined. Labrum evident, although so little so in *Catadelphus* that it may be concealed by a slight deflection. Mandibles bidentate except in *Catadelphus buccatus* (Cresson), the upper tooth larger, the lower rather short and weak in all species of *Catadelphus.*

Thorax always deeper than broad. Scutel strongly elevated, of variable shape. Propodeum (fig. 1) always strongly shortened antero-posteriorly, much wider and deeper than long, rather steeply declivous both before and behind a transverse ridge formed along the sometimes strong, sometimes obsolete costulae and the small areola, the latter usually in the form of a polished boss; all carinae visible (although often subobsolete) except the basal abscissae of the longitudinal median carinae weak or wanting, in the former case often confluent.

Wings large in our genera, the areolet usually strongly narrowed above and subpetiolate.

First abdominal segment with a long slender petiole, which is usually considerably deeper than broad, the postpetiole subtriangular, two or more times as wide as the petiole, but rather narrow in relation to the following abdominal segments. Gastrocoeli present, moderately strongly impressed. Ventral fold weak and not extending beyond the third segment. Apex of abdomen in female usually rather blunt, apex of hypopygium almost attaining the apex of the seventh tergum and not separated from the visible part of ovipositor (except the apex of hypopygium does not attain the apex of sixth tergum in *Catadelphus*) except in *Macrojoppa*, in which the apex of the abdomen is rather acute, the hypopygium not exceeding the apex of fifth tergum and separated from visible portion of ovipositor by the reflexed margins of the sixth tergum. Claspers large and longer than broad, showing more difference between individuals of the same species than between genera and showing no apparent specific differences.

The North American genera fall into the two groups indicated in the key.

Key to the Nearctic Genera of Trogini

1. Abdomen with terga noticeably narrower at base than apex, the posterior angles of each projecting laterally beyond the base of the succeeding one (fig. 3), strongly striate or rugulose and reticulate, depressed and flattened above; head narrowed behind, cheeks and temples flat or nearly (fig. 2) (Trogus group)....................2

   Abdomen with terga not much narrower at base than apex of each preceding one (fig. 12), not striate or rugulose, but coriaceous or punctate, convex and not flattened above; head not or very slightly narrowed behind, the cheeks and temples buccate (fig. 4) (Catadelphus group) 3

2. Front without horns, at most with a pair of minute protuberances not at all resembling horns; clypeus straight at apex in our species; female with antennae lanceolate; abdomen subacute at apex, with strong, rather straight longitudinal rugulae and weak transverse ones, sometimes appearing longitudinally grooved or striate. *Macrojoppa* Kriechbaumer

Front in our species with a pair of acute or subacute horns, sometimes rather small; clypeus concave at apex in our species; antennae not lanceolate; abdomen blunt at apex, rugose-reticulate, the longitudinal ridges not or but little stronger than the transverse and not straight ....*Trogus* Panzer

3. Postpetiole with a pyramidal elevation at elbow (fig. 11); scutel subglobose, margined only at base; clypeus with a pair of tubercles or papillae at apical middle (sometimes obsolete). *Conocalama* new genus

Postpetiole not pyramidal; scutel usually pyramidal, conical, or margined beyond base..4

4. Areola of propodeum with open center surrounded by carinae; scutel subglobose-subquadrate, margined to middle or nearly. *Catadelphus* Wesmael

Areola represented by a polished boss; scutel conical or pyramidal, not margined except at base...5

5. Clypeus apically concave (fig. 11); abdomen opaque, slightly constricted at sutures...............................*Gnamptopelta* new genus

Clypeus straight or slightly convex; abdomen subpolished, not constricted at sutures..6

6. Lateral margins of clypeus subparallel, apex with a pair of small tubercles at apical middle or convexly sinuate; scutel subconical, flattened only anteriorly; area dentipara densely punctate......*Callajoppa* Cameron

Lateral margins of clypeus obliquely convergent, apical margin straight; scutel pyramidal, more or less flattened on four sides, summit transverse; area dentipara rather coarsely rugose-reticulate. *Tricyphus* Kriechbaumer

MACROJOPPA Kriechbaumer

Trogus auct., ex parte.

1898. *Macrojoppa* Kriechbaumer, Berl. Ent. Zeitschr., XLIII, pp. 22 and 131.

1898. *Macrojoppa* Kriechbaumer, Ent. Nachr., XXIV, pp. 2 and 21. [Genotype: *Trogus blandita* Cresson.]

1913. *Aglaojoppidea* Viereck, Proc. U. S. Nat. Mus., XLVI, p. 368. [Genotype: *Trogus fascipennis* Cresson.] [New Synonymy.]

Head very abruptly narrowed behind, thin antero-posteriorly, temples and occiput slightly concave, head vertically elongate in front view, narrowed below; front without horns although sometimes with very small projections of indefinite shape and not at all suggesting horns. Clypeus, in *blandita* and *fascipennis*, with lateral margins subparallel and apical margin straight. Antennae long and slender, in male strongly serrate, in female strongly lanceolate beyond middle.

Scutel moderately strongly elevated, subconical but apex scarcely pointed (in specimens examined). Propodeum with a narrow, triangular, elevated areola (not open centrally), the posterior edge of which forms a sharp angle; the basal areas smooth and level with the costulae, falling abruptly to the punctate middle areas, paracostulae obsolete. Hind coxae long, nearly attaining apex of first tergum. Wings with a brown band, at least at tip, usually also with spots or bands at base and middle, in some species wholly brown; areolet obliquely trapezoidal and petiolate.

Petiole of abdomen polished, with vertical rugae at sides (not especially strong) and with two rather weak longitudinal carinae near middle; postpetiole only about twice as wide as petiole and not at all abruptly enlarged. Abdomen moderately depressed, somewhat flattened above, rather abrupt at sides, terga more or less angularly emarginate at bases; strongly longitudinally rugoso-striate, the ridges rather straight and about equal to the grooves, the latter sometimes the more noticeable, with very weak transverse reticulations (stronger toward the sides), the fifth and following terga in *fascipennis* and the sixth and following in *blandita* without any sculpture save a few scattered punctures. Abdomen showing almost no sexual difference in the terga, the sixth being intermediate in size between the fifth and seventh in both sexes, although slightly larger relatively in male than in female. Hypopygium of female rather narrow and triangular, much retracted from apex of abdomen, not exceeding apex of fifth tergum. Visible portion of ovipositor separated from apex of hypopygium by the reflexed margins of the sixth tergum; tip of ovipositor slightly exceeding the apex of abdomen. Claspers of male rather broadly truncate at apex. Abdomen rather pointed in both sexes.

The number of abdominal segments mentioned in the key which constitutes the original description does not agree with the condition in the genotype.

The above description is based on several specimens of both sexes of the genotype, including the holotype, and on the holotype and only known specimen of the only species recorded from our area (*Macrojoppa californica* Cameron does not belong here being a synonym of *Trogus vulpinus* Grav., q.v.). The description of the wing coloration is taken from the original description.

Distribution known to me is from Texas to Brazil and Bolivia.

Macrojoppa fascipennis (Cresson) new combination

1877. *Trogus fascipennis* Cresson, Trans. Amer. Ent. Soc., VI, p. 195.
1913. *Aglaojoppidea fascipennis* Viereck, Proc. U. S. Nat. Mus., XLVI, p. 368.

Ferruginous; antennae, posterior legs, except coxae and base of their tibiae, and two apical segments of abdomen black; face, clypeus, scape beneath, and basal third of posterior tibiae yellowish. Wings bright yellow, a broad band a little before middle and a broader one at tip blackish. Abdomen depressed, postpetiole and three following segments above coarsely longitudinally aciculate.

The above is reproduced from the original description to which little can be added other than what has been said in the description of the genus. Length 18 mm.

Known only from the unique type from Texas (F. H. Strecker) [ANS].

TROGUS Panzer

(figs. 1, 2, 3)

1806. *Trogus* Panzer, Krit. Rev., II, p. 80. [Genotype: (*Ichneumon coerulator* Fabricius) = *Trogus lapidator* var. *coerulator* (Fab).]
1868. *Dinotomus* Forster, Verh. naturh. Ver. preuss. Rheinl., XXV, p. 188 (no species). [1896 Berthoumieu, Ann. Soc. Ent. France, LXXV, p. 296. Genotype: (*Dinotomus lapidator* Berth., not Fab.) = *Ichneumon coerulator* Fab. Isogenotypic with *Trogus* Panzer.]
1868. *Psilomastax* Tischbein, Stett. ent. Zeit., XIX, p. 255. [Genotype: *Psilomastax pyramidalis* Tischb. = (*Psilomastax pictus* Kriechb.). Congeneric with genotype of *Trogus* Panzer.]

Trogus alboguttatus Gravenhorst, designated as genotype of *Trogus* by Westwood, and *Ichneumon lutorius* Fabricus, considered the genotype by the majority of European authors apparently from before Förster, were not originally included and therefore cannot serve as genotypes. *Psilomastax* and *Dinotomus*, used by European authors for this genus, must fall as synonyms.

Head seen from above twice as broad as long, narrowed behind, temples and cheeks flat or weakly convex; front with a pair of horns, usually more or less laterally compressed, sometimes thorn-like, sometimes ridge-like, sloping more gradually toward antennae and nearly vertical on upper side, often weak in *vulpinus*, wanting in some tropical species. Clypeus with concave apical margin and converging lateral margins (in species examined). Antennae setiform, serrate in male (less strongly than in *Macrojoppa*), not lanceolate in female.

Notauli wanting. Scutel usually strongly elevated and conical, posterior surface usually distinctly concave in profile, occasionally less strongly elevated and more or less rounded, but in such case the pointed apex is nevertheless distinguishable. Propodeum with posterior face quite abrupt and only slightly convex, the areola represented by a transverse boss, often with a false areola formed behind it by the transverse rugae of the petiolarea.

Hind coxae not nearly attaining apex of postpetiole. Wings with areolet moderately large, rhomboidal, very short petiolate.

Petiole of abdomen with strong longitudinal carinae above, which are separated by the width of the segment, petiole deeper than broad; postpetiole four or more times as broad as petiole, subtriangular and somewhat abruptly enlarged. Abdomen rather strongly depressed and flattened above, with a more or less distinct median longitudinal elevation and a lateral longitudinal elevation at each side which helps to render the sides of the terga rather abrupt. Terga quite strongly longitudinally rugose with transverse rugae which are only slightly weaker, appearing distinctly reticulate. Seven visible terga, the seventh in male and the sixth and seventh in female much smaller than those between them and the first. Claspers of male rather narrow, tapering to apex, with a concave polished area at antero-ventral edge near base. Apex of abdomen rather blunt in both sexes, especially in female. The broad, nearly semicircular hypopygium of female almost attaining apex of abdomen and almost wholly concealing ovipositor.

Described from specimens of the genotype and of all the known species of the United States and Canada.

Distribution known to me · principally Holarctic, but also recorded from Mexico (specimen seen by me) and from East India. The species of this genus are parasitic on *Papilio* and on various of the larger species of Nymphalidae.

Key to Species of Trogus

1. Wings clear yellow, smoky at tip; abdomen yellow except one or two basal segments black.............................*flavipennis* Cresson
   Wings wholly fuscous or fuliginous; abdomen black or ferruginous or both...2
2. Entire body ferruginous except sutures of scutel often and mesopleura in part rarely, black (mesothorax never mostly black); frontal horns usually weak, distinctly flattish and extended below toward antennae. *vulpinus* Gravenhorst
   Body always more or less black (mesothorax mostly black); frontal horns always well developed, not much flattened or extended below..3

3. Inner and outer orbits broadly yellow as is the postscutel usually; mesonotum never wholly black; abdomen rarely mostly black or blackish.......................................*edwardsii* Cresson
   Orbits and postscutel never yellow, black to ferruginous; mesothorax wholly black, as is the entire body usually..........*fulvipes* Cresson

Trogus flavipennis Cresson

1863. *Trogus flavipennis* Cresson, Proc. Ent. Soc. Phila., III, p. 287.

Head, antennae except tips, tegulae, scutels, anterior femora, and all tibiae and tarsi, fulvous; tips of antennae, thorax except parts mentioned, coxae, posterior femora, and first or first and second terga, black; wings yellow, apical margins smoky; abdomen dull yellow, more or less fulvous adjacent to the black basal part. Length about 18 mm.

COLORADO: No other data, [ANS; *type, paratype*, and eight other specimens]. El Paso County, June 28, 1914; [US; 1]. Bailey, Aug. 1896, [Kans; 1]. Manitou Park, (F. H. Snow), [Kans].

NEW MEXICO: Magdalena, (F. H. Snow), [Kans; 1]. Jemez Springs, June 16, 1913, (John Woodgate), [Tow. CU; 1].

UTAH: Silver Lake, July 1914, (H. Skinner), [ANS; 1]. Buckskin Valley, Iron County, [US].

Trogus fulvipes Cresson

1869. *Trogus fulvipes* Cresson, Trans. Amer. Ent. Soc., II, p. 93.
1897. *Trogus apicatus* Davis, Trans. Amer. Ent. Soc., XXIV, p. 352. (New synonymy.)

Usually wholly black except labrum, knees, tibiae and tarsi, and anterior femora of male, yellow; sometimes postscutel ferruginous. A single specimen in the United States National Museum, bred June 19, 1936 from *Papilio turnus*, Bar Harbor, Me., has entire face, postscutel, propodeum, and abdomen except toward apex above, ferruginous (duller on abdomen which is blackish above toward apex), femora fuscous except extreme apex. The black on the abdomen has always a violaceous reflection. The pale spot at apex of wing found in some specimens is too variable to distinguish Davis's species.

MAINE: No other data, [ANS; *type* and one other specimen]. Bar Harbor, bred June 19, 1936, from *Papilio turnus*, [US; 1]. Bar Harbor, [BS; 2]. Salisbury Cove, [BS; 2]. Southwest Harbor, [BS; 1].

New Hampshire: No other data, [ANS; 1]. Crawford Notch, (Mrs. Slosson), [ANS; type of *Trogus apicatus* Ds.]. No other data, (Bartlett), [BS; 1].

New York: Loch Muller, Essex County, [H. H. Swift].

Michigan: White Fish Point, July 7, 1914, (A. W. Andrews), [US; 1].

Colorado: No other data, [ANS; 1].

Canada: " 188 ", no other data, [Can; 1].

Quebec: Coquey Hill, July 1921, (Perch), [Can; 1].

Ontario: Nipigon, (J. Fletcher), [Can; 1]. Kearney, September 8, 1909, (M. C. VanDuzee), [Cal; 1].

Manitoba: Aweme, July 13, 1907, [Can; 1].

Saskatchewan: Waldheim, June 26, 1923, (N. J. Atkinson), [Can; 1].

British Columbia: Vernon, August 12, 1917, (M. H. Ruhmann), [Can; 1].

Trogus edwardsii Cresson

1877. *Trogus edwardsii* Cresson, Trans. Amer. Ent. Soc., VI, p. 195.

1894. *Trogus fletcheri* Harrington, Can. Ent., XXVI, p. 245. (New synonymy.)

The synonymy of Harrington's species is based on comparison of a specimen determined by me as *edwardsii* with the type of *fletcheri* by Mr. G. S. Walley.

Head with at least the stemmaticum black, usually mostly black above and behind, face and more or less of antennae ferruginous, inner and outer orbits broadly yellow. Thorax mostly black; mesonotum with two longitudinal ferruginous lines, sometimes more extensively ferruginous; scutel and tegulae fulvo-ferruginous to ferruginous, postscutel usually yellow. Abdomen reddish ferruginous, often with a black spot on the disk of one or more of the terga; in one specimen (Cocur d'Alene, Idaho) abdomen is wholly blackish.

Frontal horns strong, acute, not much compressed, not continued ridge-like toward antennae.

This species may prove to be merely a subspecies of *vulpinus*; but at present it is distinguishable by the strong horns of the front with almost no trace of vertical flattening (which seems to always be present in the rare specimens of *vulpinus* in which the horns are large) and by the mostly black mesothorax, the mesopleurum being more than half black and the mesonotum being black at least around the edges, which is not the case in any *vulpinus* seen by me. Furthermore, the specimens of *vulpinus* having black on the mesopleurum are from Pennsylvania or nearby states, giving a geographic factor in dubious cases.

IDAHO: Coeur d'Alene, [US; 1]. Cedar Mt., Moscow, July 25, 1930, (Mclane), [US; 1].

WASHINGTON TERRITORY (included Washington and Oregon): No other data, [ANS; 1].

BRITISH COLUMBIA: Vancouver Island, [ANS; type]. Vancouver Island, (J. Fletcher), [Can; 1]. Vancouver Island, (reared from *Papilio* sp.), [Can; type of *Trogus fletcheri* Harrington]. Vancouver, June 29, 1903, (P. V. Harvey), [US; 1].

Trogus vulpinus Gravenhorst

1829. *Trogus vulpinus* Gravenhorst, Ichn. Europaea, II, p. 389.

1846. *Trogus exesorius* Brullé, Hist. nat. Ins. Hym., IV, p. 298, pl. 43, fig. 2. (In Lepeletier de St. Fargeau, Suites à Buffon.)

1911. *Macrojoppa californica* Cameron, Soc. entom. (Stuttgart), XXVI, p. 35. [Synonymized by Morley, Rev. Ichn., IV, p. 65, 1915.]

Wholly ferruginous, the wings dark fuliginous; inner and outer orbits more or less yellow; tibiae and tarsi yellowish. A good many specimens show some black in the sutures of scutel, and a very few have stemmaticum and more or less of mesopleura black; legs and abdomen are never marked with black, mesothorax is never mostly black. Specimens from California tend to have a deeper and redder body color and darker wings.

Frontal horns usually much weaker and smaller than in any of the other species and are more flattened and ridge-like, being more or less extended toward antennae below.

This species has been bred from *Papilio turnus* L. (*glaucus* L.), *P. asterias* Cr. (*polyxenes*), *P. ajax* auct. (*marcellus* Cr.), *P. rutulus*, *P. troilus*, *P. eurymedon*, *P. zelicaon*, *Vanessa cardui* and one specimen examined is attributed to *P. palamedes* but the chrysalid is that of *glaucus*. Probably parasitic on any species of *Papilio* and some of the larger nymphalids.

Because of the large number of records only states are given. New Hampshire, Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, West Virginia, North Carolina, Georgia, Florida, Alabama, Ohio, Illinois, Missouri, Kansas, Nevada, Washington, Oregon, California. Ontario, Canada.

If records had been taken from a large number of institutions, records would doubtless have been found for all the states in the United States and at least all the southern provinces of Canada; for the distribution indicated above suggests that the species occurs throughout the area dealt with in the present paper.

CONOCALAMA new genus [4]

Trogus auct., ex parte.

Most nearly related to *Callajoppa* Cameron (=*Trogus* auct. not Panzer), with which it agrees in the form of the clypeus and to which it approaches most closely in the form of the aedeagus, differing in the form of the scutel and first tergum, and differing slightly in the general habitus.

Head buccate, the greatest width of head usually somewhat greater than distance across eyes in dorsal view and about twice the length, in anterior aspect quadrate and scarcely narrowed below; temples as broad as short diameter of eye, angle between cheeks and occiput obtuse and rounded (if the carina be ignored). Clypeus with a pair of median apical tubercles or papillae, rarely fused into one or obsolete; lateral margins almost parallel, anterior margin straight or slightly concave. Antennae about as long as abdomen, lanceolate in apical third or more in female, serrate in male.

Thorax stout, pleura, and especially the subalar calli, prominent. Scutel subglobose tending toward subconic, rather broadly rounded above, margined at extreme base. Propodeum weakly convex behind the transverse ridge; areola somewhat triangular, usually a solid boss, rarely with a central opening. Wings long, areolet small to moderate, subtriangular and short petiolate. Hind femora not or scarcely exceeding apex of second tergum.

First abdominal segment with the petiole long and narrow, about one and one-half times as long as postpetiole, the latter somewhat over three times as wide as petiole and slightly longer than broad, with a strong subpyramidal eminence where it joins the petiole. Abdomen (exclusive of first segment) about three times as long as greatest width. Hypopygium of female nearly attaining apex of seventh tergum.

The species are mostly parasitic on sphingids, although *nubilipennis* is recorded in the New Jersey list from (*Pyrrharctia*) *Isia isabella* the common bicolored woolly-bear, and *Papilio polyxenes* the parsnip butterfly.

GENOTYPE: *Trogus brullei* Cresson, 1877.

Divisible into two subgenera as indicated below.

Key to Subgenera and Species of Conocalama

1. Margin of clypeus straight (fig. 7); antennae of female rarely with annulus, which if present is very broad and orange in color; terga rarely impressed at sutures, coriaceous or very finely punctate, usually very weakly shining, not especially hairy; not ferruginous with apex of abdomen black. *Conocalama* new subgenus..................2

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[4] κῶνος, cone; καλάμη, stalk.

Margin of clypeus weakly but distinctly concave (fig. 5), rarely almost straight; antennae of female with a distinct yellowish annulus beyond middle which is narrower than the apical dark part; terga distinctly impressed at sutures, opaque and not at all shining, rather strongly hairy; ferruginous with third and following terga black.
Tmetogaster (new subgenus) *nubilipennis* (Haldemann)

2. Thorax and abdomen usually wholly black, rarely more or less piceous or with limited yellowish marks..................*brullei* (Cresson)
Abdomen mostly red, brown, or yellow.............................3

3. Thorax wholly black, except sometimes a small yellowish spot on postscutel and an adjacent edge of scutel; abdomen red at apex....4
Thorax with some brown or yellow marks other than those mentioned above...5

4. Abdomen except first tergum wholly red.............*copei* (Cresson)
Abdomen with one or more black sutures.
copei var. *nigrocincta* (Hasey)

5. Wings clear yellowish, fuscous at apex............................6
Wings wholly fuscous or the yellow color does not extend the full width of the wing except at extreme base; (if abdomen is red with base and apex black, see 6)....................................8

6. All terga brownish, shading to yellow toward apex, amount of yellow increasing caudad; thorax with little or no black; length 25 to 30 mm.
occidentalis mellosa (Cresson)
Terga not at all brownish (or if rarely brownish, then with broad black bands on abdomen and black pleura): yellow (luteous) or rufous; thorax mostly black, rarely with little black; length 21 to 25 mm....7

7. Abdomen red, black at apex............*occidentalis bolteri* (Cresson)
Abdomen yellow (rarely brownish with broad black bands on terga), usually more or less black at sutures or apex.
occidentalis var. *luteata* new variety

8. Male with second tergum distinctly longer than greatest width, all terga at least nearly as long as wide; female with tergum three about as long as basal width........................*fuscalata* new species
Second and following terga of both sexes distinctly wider than long, third tergum at apex in male, at base in female, at least one-fifth wider than long..9

9. Abdomen extensively marked with yellow; thorax mostly black.....10
Abdomen wholly ferruginous or with narrow black basal lines on one or more terga...11

10. Abdomen yellow (luteous) with more or less black markings (rarely brownish with broad bands of black), rather weakly sculptured, smooth and subpolished, incisures not impressed.
occidentalis occidentalis (Cresson)

Abdomen yellow and ferruginous, with narrow black cross lines, strongly punctured and opaque, incisures strongly impressed so that terga appear convex from side view................*galbinata* new species

11. Forewing with a longitudinal clear yellow streak along costa before stigma, dark portion with a golden gloss, not at all violaceous; anterior and posterior orbits broadly and distinctly yellow; antennae of female usually black or blackish at base above, of male rather broadly black in entire length above................*rileyi* (Cresson)

Forewing wholly dark fuscous except at extreme base, with a distinct, usually very strong, violaceous reflection; head either wholly ferruginous or with a small indistinct spot on scape beneath and narrow, indistinct line on inner orbits only, yellow; antennae of female entirely orange-fulvous at base, of male only narrowly blackish in entire length above.........................*violipennis* new species

TMETOGASTER new subgenus [5]

Anterior margin of clypeus concave (rarely almost straight).

Abdomen densely hairy, strongly confluently punctate-reticulate and opaque. Postpetiolar elevation rather strongly angular, the posterior surface somewhat concave. Sutures of abdomen strongly depressed, terga appearing convex in lateral view. Aedeagus as in figure 6.

This species would not merit subgeneric rank on external characters; but the marked disparity in the form of the aedeagus from all the other species of the genus (in view of the apparently generic value of this feature throughout the tribe) has led to the erection of a separate subgenus.

GENOTYPE: *Trogus nubilipennis* Haldeman (Monobasic).

Conocalama (Tmetogaster) nubilipennis (Haldeman), new combination

1863. *Trogus nubilipennis* Haldeman, Proc. Ent. Soc. Phila., III, p. 127.

Ferruginous, third and following terga black; tibiae, except tips, and tarsi yellow; face and scape beneath of male yellow; male antennae black, yellowish beneath toward apex; female antennae black with yellowish annulus. Wings strongly infumated, with a violaceous reflection, and occasionally with more or less extensive clear yellow areas toward base and along costal margin of wings. Length about 21 mm.

NEW YORK: Long Beach, Long Island, July 12, 1924, (F. M. Schott), [US; 1]. Poughkeepsie, June 22, 1936, (H. K. Townes), [Tow.]. Bemus Point, July 20, 1937, (H. K. Townes), [Tow.].

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[5] τμητός, cut; γαστήρ, venter.

NEW JERSEY: Orange Mountain, [US; 1].

PENNSYLVANIA: Sterling, (parasite on *Ampelophaga;* issued May 11, 1896), [US; 1]. Mount Holly Springs, July 21, 1918, (R. M. Fouts), [US; 1]. Inglenook, June 27, 1912, [US; 1]. Greensburg, June 22, 1934, (D. H. Cross), [Tow.]. Germantown, Philadelphia, July 3, 1936, [HPH].

MARYLAND: Jackson's, July 3, 1911, (P. R. Myers), [US; 1].

OHIO: Summit County, June 16, 1935, (L. J. Lipovsky), [Kans.; 1].

ILLINOIS: "Peabody Collection", [Ill; 1].

CONOCALAMA new subgenus

The only characters which distinguish this subgenus from the preceding in all cases are the aedeagus and the apical margin of the clypeus.

Apical margin of clypeus straight. Incisures of abdomen rarely (*galbinata* n. sp.) impressed, terga never densely hairy and opaquely punctate only in *galbinata* n. sp., coriaceous or weakly punctate and somewhat shining in all others. Postpetiolar elevation with less distinct angles and not appreciably concave on posterior face (except *galbinata* n. sp.). Aedeagus as in figure 9.

Distributed throughout North America. I am unable to recognize this subgenus from any reference in the literature from outside the limits of the present paper; but a specimen quite typical of it is in the collection of the Academy of Natural Sciences of Philadelphia from Brazil, suggesting that the group is distributed throughout the New World.

Conocalama (Conocalama) brullei (Cresson), new combination

1877. *Trogus Brullei* Cresson, Trans. Amer. Ent. Soc., VI, p. 196.

Usually wholly black except antennae, which are orange with black tips, and anterior tibiae and tarsi, which are more or less fulvous or testaceous. Anterior orbits rather often yellow. A single specimen seen in this study has head mostly yellowish, the thorax and basal segments of abdomen more or less marked with fulvous to piceous. Wings wholly dark fuliginous. Very variable in size, ranging from about 20 to about 28 mm.

MASSACHUSETTS: No other data, [ANS; 1]. Revere, Gipsy Moth Laboratory, (no. 12165F8 ex *Paonias myops*), June 11, 1921, [US; 1]; June 21, 1921, [US; 1]. Provincetown, September 4, 1891, [US; 1]. Auburndale, [BS; 1]. Mt. Greylock, [BS; 1]. Nantucket, [BS; 2]. Newton Upper Falls, [BS; 1]. Westport Factory, [BS; 1].

CONNECTICUT: No other data, [ANS; *type* and 1 *paratype*].

NEW YORK: Bemus Point, August 5, 1937, [Tow.; 1]; August 12, 1937, [Tow.; 1]; August 23, 1937, [Tow.; 1]. Farmingdale, August 6, 1938, [Tow.; 1]; August 7, 1938, [Tow.; 1].

PENNSYLVANIA: No other data, [ANS; 1 *paratype*].

GEORGIA: No other data, [ANS; 1].

TEXAS: Colorado County, June 2, 1922, (Mrs. Grace Wiley), [Kans; 1].

COLORADO: no. 1672, [US; 1].

Conocalama (Conocalama) copei (Cresson), new combination

1869. *Trogus Copei* Cresson, Trans. Amer. Ent. Soc., II, p. 94.
1873. *Trogus Copei* Provancher, Nat. Can., VI, p. 335.
1877. *Trogus canadensis* Provancher, Nat. Can., IX, p. 2. (New synonymy.)

Cresson and Provancher wrongly considered the form identified by the latter as *copei* in volume 6 of his *Naturaliste Canadien* to be distinct. Specimens examined by me show all shades of color of the hind tibiae from fulvous (*canadensis*) to black (*Copei* as originally described).

Head, thorax, and petiole black, inner orbits and small spot on postscutel and adjacent edge of scutel sometimes yellow; remainder of abdomen rufous; wings dark fuliginous with violaceous reflection; all coxae and posterior femora black, four anterior tibiae and tarsi mostly, four anterior femora to small extent, fulvous; hind tibiae and tarsi varying from black to fulvous.

NEW HAMPSHIRE: Franconia, [US; 1].

MASSACHUSETTS: Revere, (Gipsy Moth Laboratory no. 12165F8 ex *Paonias myops*), June 21, 1921 and June 28, 1921, [US; 2]. West Newton, [BS; 1]. Riverside, [BS; 1].

NEW YORK: Ithaca, August 4, 1885, [Tow. CU; 1]; August 20, 1890, [US; 1].

NEW JERSEY: Boonton, July 12, 1901, [ANS; 1].

PENNSYLVANIA: Springfield, Delaware County, July 29, 1936, (H. P. Hopper), [Tow.; 1].

WEST VIRGINIA: No other data, [ANS; *type*].

ILLINOIS: No other data, [Ill; 1]. Urbana, September 15, 1930, [Ill; 1].

CANADA: No other data, [ANS; 1]. "26.7", [Can; 1]. "H. 227", [Can; 1].

QUEBEC: Queen's Park, Aylmer, July 29, 1924, (A. R. Graham), [ANS; 1]; July 9, 1924, (C. B. Hutchings), [Can; 1]; August 15, 1924, (A. R. Graham), [Can; 1]. St. Therese, (J. B. Mignault; *teste* Harrington), [Can; 1]. La Trappe, August 1, 1935, (J. Ouellet), [ANS; 1]. Cottage Beaulieu, Beaulieu, (A. R. Graham), [Can; 1].

ONTARIO: "East Ontario", [Can; 1]. Toronto, (no. 347), [ANS; 1]; Toronto, August 25, 1893, [Can; 1]. Ridgway, July 9, 1908, [US; 1].

ALBERTA: High River, (T. Baird), [Can; 1].

Conocalama (Conocalama) copei var. **nigrocinctus** (Hasey), new combination

1925 *Trogus nigrocinctus* Hasey, Ent. News, XXXVI, p 306

Distinguished from the typical form by having transverse black bands at base of one or more terga behind the first.

MASSACHUSETTS. Revere, (Gipsy Moth Laboratory no 12165F8 ex *Paonias myops*), June 24, 1921, [US; 1].

NEW YORK: No other data, (J. H. Comstock), [CU; *type*—not seen by me.

PENNSYLVANIA: Harrisburg, September 1927, (J Knull), [US; 1].

Conocalama (Conocalama) occidentalis (Cresson), new combination

1869 *Trogus occidentalis* Cresson, Trans Amer Ent. Soc, II, p 93.

Despite the comparatively small numbers of specimens studied by me, the presence of annectent forms has led me to treat three other species as synonyms of this: two of them as subspecies, the third as an absolute synonym. It is interesting to notice the gradual increase in size of the subspecies from north to south. Further notes will be found under the subspecies.

Concocalama (Conocalama) occidentalis bolteri (Cresson), new combination

Trogus Bolteri Cresson, Trans. Amer. Ent. Soc, II, p 94, ♂.
1873 *Trogus quebecensis* Provancher, Nat. Can, VI, p. 335, ♀.

The distinction between *bolteri* and *quebecensis* was based on the wholly black coloration of the antennae above in the former, only the apex being black in the latter. This, however, is merely a form of chromatic antigeny, being a common, although not universal, point of divergence between the two sexes throughout the genus.

Head and thorax mostly black, marked with yellow or reddish; abdomen red with most or all of the first tergum and a variable number of apical terga, black (usually only the second, third, and sides of fourth red). Legs fulvous, hind coxae and posterior side of hind femora black. Wings clear yellow, infumated at apex.

Thorax of one specimen almost wholly red (Calgary, Alta., 2 July 1922), a second from the same locality could just as well be placed in the next subspecies, and a third from Monterey, Mass. has the wings wholly dark.

MAINE: Mt. Katahdin, Aug. 19, 1902, [US; 1].

NEW HAMPSHIRE: Mt. Washington, [US; 1].

MASSACHUSETTS: Monterey, July 9, 1919, (C. A. Frost), [BS; 2].

MICHIGAN: Whitefish Point, July 4, 1913, (A. W. Andrews; no. 82), [US; 1].

NOVA SCOTIA: Berwick, August, 1917, (E. Buckanam), [Can; 1].

ONTARIO: Hymers, July 21, 1910, (H. Dawson), [Can; 1]. Mer Blanc, Ottawa, August 8, 1923, (F. P. Ide), [Can; 1].

MANITOBA: Aweme, July 25, 1911, (N. Criddle), [Can; 1]. Mt. Aylmer top, (on snow), July 1921, [Can; 1].

ALBERTA: Banff, August 30, 1922, (C. B. D. Garrett), [Can; 1]. Waterton, August 13, 1922, [ANS; 1]. Calgary, July 8, 1922, (G. Salt), [US; 1]; July 2, 1922, (G. Salt), [US; 1].

BRITISH COLUMBIA: Victoria, [Can; 1]. Chilcotin, August 8, 1920, (E. R. Buckell), [Can; 1].

NORTHWEST TERRITORIES: Fort Norman, Mackenzie River, July 6, 1922, (C. H. Crickmay), [Can; 1].

Conocalama occidentalis occidentalis (Cresson)

I have divided this subspecies into two varities based on wing color. The type belongs to the rarer of these varieties, known to me from only three specimens.

Wings uniformly dark, or with the yellow color not extending across the full width of the wing except at extreme base. Abdomen wholly yellow except petiole or apex also black; in the California specimen the abdomen is brownish with broad black bands.

DAKOTA TERRITORY (including North and South Dakota): No other data [ANS: *type*].

OREGON: Canyon City, 3498 ft., July 15, 1936, (R. E. Rieder), [Ore; 1].

CALIFORNIA: Tallac, Eldorado County, July, (F. E. Blaisdell), [Cal; 1].

Conocalama (Conocalama) occidentalis var. **luteata** new variety

This is the common form of the subspecies *occidentalis.*

Wings yellow, fuscous at apex. Thorax black, more or less marked with yellow and brown, mesonotum usually brown, upper margin of the pronotum and scutels yellowish; abdomen luteous yellow, usually the petiole and cross-bars near base of terga black, occasionally black at apex or wholly yellow. In one or two specimens abdomen is brownish with broad black basal transverse bars on terga. Length 21 to 26 mm.

Merges with *bolteri* in British Columbia and with *mellosa* in Colorado.

Type.—Female; Colorado, no other data; [Academy of Natural Sciences of Philadelphia, type no. 4217].

Paratypes and *allotype.*—12 ♂, 10 ♀; from following localities:

Colorado: No other data, [ANS; 3♀, *allotype* ♂ and 7 other ♂]; (Snow), [Kans; 1♀]; "no. 1733", [US; 1♀]. Custer County, (T. D. A. Cockerell), [US; 1♀]. Long's Peak Inn, 9000 ft., July 11, 1926, (E. C. Van Dyke, [Cal; 1♂].

Washington Territory: No other data, [ANS; 1♂].

Alaska: Skagway, near Denver Glacier, July 1, 1923, (J. A. Kusche), [Cal; 1♂].

British Columbia: Departure Bay, Vancouver, August 11, 1913, (E. M. Williamson), [US; 1♀]. Osoyoos, [Can; 1♀]; [ANS; 1♀]. Chilcotin, July 29, 1920, (E. R. Buckell), [Can; 1♀]. Victoria, August 14, 1903, (E. M. Anderson), [US; 1♂; C. W. T. *quebecensis* by Gahan].

Conocalama (Conocalama) occidentalis mellosa (Cresson), new combination

1875. *Trogus mellosus* Cresson, Rept. Wheeler Exp., p. 708.

Distinguished from the other subspecies by the largely ferruginous coloration of the thorax and abdomen, with little or no black marking, and by the larger size. The head is extensively marked with yellow as are the posterior margins of terga. Size 25 mm. or more.

Colorado: Grand Junction, June 18, 1916, (H. K. Plank; Quaintance no. 15599), [US; 1].

New Mexico: No other data, (T. V. Brown?; Wheeler Expedition), [ANS; *type*]. Las Vegas, May 25, 1902, (Cockerell), [ANS; 1]. Santa Fe, July, (Cockerell; no. 1188; Vese Boyle), [US; 1]. A specimen in the ANS collection is doubtless from New Mexico, but only the date, July 27, is legible.

Conocalama (Conocalama) rileyi (Cresson), new combination

1869. *Trogus rileyi* Cresson, Trans. Amer. Ent. Soc., II, p. 95.

Body wholly ferruginous, occasionally with some black markings on thorax and abdomen, the latter always without yellow marks. Head with anterior and posterior orbits, and often scape beneath, broadly and distinctly yellow. Antennae of female orange-fulvous, black at apex, and usually narrowly black on basal third above; those of male rather broadly black or blackish in entire length above. Wings fuscous, usually yellow along costa, with a golden gloss on dark portions, not at all violaceous. Length 28 to over 30 mm.

ILLINOIS: No other data, [type; collection of C. V. Riley, apparently lost].

SOUTH DAKOTA: Brookings, [ANS; 1].

NEBRASKA: Pine Ridge, July, [ANS; 1].

KANSAS: Meade County, [US; 1]. Riley County, July, (Marlatt; no. 128), [US, 1]; September, (Popenoe), [US; 1]. Osage County, June 5, 1923, (R. H. Beamer), [Kans; 1]. Logan County, (F. X. Williams), [Kans; 1]. Garden City, June 1896, (H. Menke), [US; 1].

Conocalama (Conocalama) violipennis new species

This species is nearest to *rileyi* Cresson, from which it may be distinguished by the very dark color and strong violaceous reflection of the wings, by the absence of clear yellow areas in the forewings beyond the extreme base and by the head being usually wholly ferruginous or at most with narrow indistinct yellow lines on inner orbits and indistinct spot on underside of scape, the posterior orbits always wholly ferruginous, and by the antennae of female being wholly fulvous except apex, the dark color on upper side of male antennae rather narrow.

Female. Length 25 mm.; forewing 19 mm.; antennae over 14 mm. (apex wanting—a female paratype 24 mm. in length, with complete antennae has them 17 mm. long and with 53 joints).

Entire body ferruginous, the thorax slightly darker except the scutel and tegulae; antennae orange-fulvous, fuscous at tip; teeth of mandibles piceous; legs ferruginous, tibiae paler; wings dark fuliginous with a very strong violaceous sheen, extreme base of both pairs of wings and costellan and base of radiellan cells clear yellow.

First joint of flagel not more than three times as long as thick; flagel widened and flattened beneath in apical third. Head about twice as wide as thick; cheeks buccate, occiput strongly indented. Face from vertex to apical margin of clypeus less than twice the interocular distance. Clypeus about three times as broad as high; anterior margin straight with a bipapillose tubercle at middle, the lateral margins nearly parallel. Malar space equal to basal width of mandible.

Thorax about one and one-third times as deep as broad; mesopleura about one and two-thirds times as high as wide. Notauli moderately strongly but not at all sharply impressed in anterior third or less.

All terga behind the first at least slightly wider than long, the third about one and one-fifth times as wide as long.

Body rather closely, moderately finely punctate and subopaque to subpolished. Propodeum closely somewhat coarsely punctate to rugose-punctate and subopaque except the juxtacoxal area polished with rather distinctly separated punctures. Entire body finely pubescent.

Type.—Female; California (with illegible county name); [Academy of Natural Sciences of Philadelphia; type no. 4219].

Allotype.—Male; Hull Valley, Lake County, California; " 1420 June 1917 " [sic: perhaps for June 14-20]; (C.D.de.B. Reynolds); [Cal].

Paratypes.—All from California as follows:

Los Angeles County, (Coquillett), [US; 1♀]; Los Angeles County, (Coquillett; no. 372), [US; 1♀]. Siskiyou County, (Coquillett, no. 372), [US; 1♀]. San Gabriel, Los Angeles County, June (C. L. Hutchinson), [US; 1♀]. Davis Creek, Modoc Co., July 11, 1922, (C. L. Fox), [US; 1♂]. Walker, Siskiyou County, June 4, 1920, (C. L. Fox), [Cal; 1♀]. Tallac, Eldorado County, July, (F. E. Blaisdell), [Cal; 1♀]. San Gabriel Mts., July 2, 1914, (F. Grinnell, Jr), [Cal; 1♀]. San Joaquin County, (J. G. Grundell), [Cal; 1♀]. McCloud, April 7, 1907, (F. X. Williams), [Cal; 1♂]. Sacramento, June 4, 1915, (M. C. VanDuzee), [HPH; 1♀]. Mt. St. Helena, Napa County, June 9, 1918, (E. P. VanDuzee), [HPH; 1♂].

The male paratype from McCloud has sutures of thorax rather broadly black and wings distinctly but not so strongly violaceous, head wholly ferruginous.

Conocalama (Conocalama) galbinata new species

Nearest to *rileyi* (Cress.) in most respects, but showing a similarity to *occidentalis mellosa* (Cresson) in coloration. Differs most strikingly from both of these forms in sculpture and form of abdomen (in which it shows a remarkable resemblance to *nubilipennis*), but also shows differences of coloration.

Male. Length 30 mm.; forewing 24 mm.; antennae about 18 mm. (apices wanting).

Head fulvous with eye margins broadly (except above), sides of face, lateral margins of clypeus, underside of scape, basal half of mandibles, labrum, and palpi flavous; occiput partly and tips of mandibles black; antennae fulvous beneath, narrowly fuscous above. Thorax black with collar, portion of pronotum adjoining coxae and propleura, mesonotum and adjacent part of pronotum, upper anterior corner of mesopleura, spot on mesopleura above posteriorly, spot at base of hind wing, and middle lateral areas of propodeum, dull ferruginous; scutels, subalar calli, and tegulae flavo-fulvous; mesosternum shading from dirty fulvous to piceous. All tibiae and tarsi flavous; anterior coxae and fore and mid femora fulvo-ferruginous, mid coxae fuscous, hind coxae and femora dark piceous marked with testaceous. Wings fuscous without violaceous sheen, with a golden gloss, outer margin paler, the darker and paler portions not intergrading; a spot at extreme base of wing, elongate mark along costa from stigma to middle of radial cell and shaped rather like the stigma, yellow; costa and stigma fulvous, veins piceous. Terga of abdomen fulvous, shading to flavous toward apex of each, the extent of the flavous coloration increasing caudad, the seventh tergum wholly flavous except the apical edge; all terga with a very narrow black line at apical edge, the first piceous at base, second to fifth with narrow transverse basal black band; venter wholly testaceous.

Serrations of the antennae very pronounced; first joint of flagel as long as scape and pedicel together and very slightly shorter than the second and third together, the fifth and following quadrate. Clypeus with a strong punctiform impression at middle, otherwise as usual for the subgenus.

The elevation on postpetiole flattened anteriorly and laterally, posteriorly slightly concave. Incisures of abdomen strongly impressed except that between the sixth and seventh terga. Second tergum distinctly wider than long. Apex of hind femora about attaining apex of second tergum.

Entire body opaquely punctate, including tegulae and subalar calli, the speculum and base of petiole polished and shining; scutel, upper part of mesopleura, coxae, and femora weakly shining, the punctures coarse and separate. Mesopleura very coarsely punctate on lower half, becoming rugoso-punctate below. Metapleura very deeply and reticulately punctate (juxtacoxal area indicated only by an irregularity in the punctation), similar but weaker punctation extending into the (not discreted) posterior pleural area and into the posterior lateral area; petiolarea transversely rugose; remainder of propodeum very densely moderately finely punctate, appearing scabrous. Abdomen densely punctate, punctures becoming finer toward apex, the seventh tergum appearing almost coriaceous.

Type.—Male; Dripping Spring, Organ Mts., New Mexico; (T. D. A. Cockerell; on *Kermes* inf. on oak branches); [U.S. National Museum Collection].

Conocalama (Conocalama) fuscalata new species

Resembles *rileyi* (Cress.) in coloration except for the lack of the yellow longitudinal streak in forewing (two of the type series had seen identified as the species mentioned). Probably most closely related to *occidentalis* (Cress.), which seems to approach it most closely in habitus. Distinct from all species of this genus known to me in the slender, elongate abdomen.

Male. Length 28 mm.; forewing 20 mm.; antennae about 17 mm. (apices wanting).

Fulvo-ferruginous; face, anterior orbits, clypeus, mandibles except tips, cheeks, fore and mid coxae, trochanters, tarsi largely, and anterior face of fore and mid femora and tibiae narrowly and indistinctly, yellow. Also yellow are tegulae, upper margin of pronotum, collar above, subalar calli, carinae at posterior margins mesopleura, lines in position of sternauli, and weak wash on scutel and postscutel. Black are: vertex, furrow between collar and pronotum, mesopleural furrows and their continuation to base of forewings, sutures and depressions of scutel and postscutel and at base and sides of propodeum. Fuscous are: upper surface of antennae, spot at anterior end of mesonotum continued caudad by a fine line to base of scutel, underside of petiole and upper side at extreme base. Mesonotum, sides of pronotum, and upper portion of mesopleura are more ferruginous than the rest of the insect, which is more fulvous. Wings moderately infumated, fuscous, not violaceous, the forewings yellow at extreme base and with a small yellow spot at base of radial cell; hindwings yellow along costa from base nearly to middle of radial cell.

Antennae setiform, slightly serrate, with more than forty-six joints; first joint of flagel as long as scape plus pedicel and as long as second and third together, three times as long as thick and one and one-half times length of second, nineteenth to twenty-second flagellar joints quadrate, those both proximad and distad longer than broad; second to twenty-seventh joints of flagel with sense-organs. Scape subglobose, emarginate nearly to base. Interocular distance about one-half distance from vertex to apical margin of clypeus; ocellocular line nearly twice postocellar line and equal to ocelloccipital line; occiput strongly concave; clypeus scarcely separated from face at middle, about twice as wide as high, narrower than face, sides very slightly oblique, angles rounded, a bipapillose tubercle at apical middle.

Thorax seen from above more than twice as long as wide, very nearly twice as deep as broad. Notauli moderately deeply impressed nearly to middle of notum. Mesopleura about one and one-half times as high as wide. A strong carinate projection on dorsum behind forewing (somewhat stronger in this species than in others). Scutel strongly elevated, the areola represented by a strongly elevated transverse boss.

Abdomen nearly twice as long as head and thorax together. Second tergum slightly longer than apical width; all terga at least nearly as long as apical width.

Entire body finely closely punctate, least closely on head and most on abdomen; with almost invisible pubescence, longer on edges of terga.

The male paratype has more yellow and more black. The allotype female has only the lateral areas of the face yellow and the yellow on the thorax limited to upper margin of pronotum, subalar calli, tegulae, scutel, and anterior and posterior margins of mesopleura. The allotype also has the wings somewhat violaceous; tergum three about as long as basal width.

Type.—Male; Catskill Mts., New York; 1883; (W. W. Hill); [Academy of Natural Sciences of Philadelphia, no. 4218].

Paratype.—Male; Elk Lake, New York, August 20, 1883; (no. 6747);[6] [ANS].

Allotype. — Female; North East, Pennsylvania; August 13, 1917; (D. Isely); [U.S. National Museum Collection].

CALLAJOPPA Cameron

Trogus auct., not of Panzer.

1903. *Callajoppa* Cameron, Entomol., xxxvi, p. 236. [Genotype: (*Callajoppa bilineata* Cam. = *Ichneumon lutorius* Fab., *fide* Uchida: Jour. Coll. Agric. Hokkaido Imp. Univ., xviii, p. 50, 1926, and Ins. Matsumurana, vii, p 26, 1932, and Heinrich,[7] Zeitschr. Angew. Ent., xxix, hft. 2, p. 398, 1934) = *Ichneumon cirrogaster* Schrank, (*v. infra*).]

Head buccate; angle between cheeks and occiput somewhat acute (disregarding the occipital carina). Apical margin of clypeus straight except for a small median pair of papillae, which may be replaced by a tubercle or both papillae and tubercle may be absent, in which case the margin is usually convexly sinuate.

Pleura and subalar calli not especially prominent. Scutel conical, slightly flattened on anterior face. Areolet four-sided, nearly triangular, subpetiolate.

Postpetiole without elevation. Abdomen not much longer than head and thorax together, minutely punctate, shining, almost smooth. Aedeagus as in figure 10.

A single European species of this genus is recorded from our area, namely the genotype. Whether this represents a Holarctic distribution or an introduction is, of course, impossible to determine.

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[6] The note referred to by this number is probably lost.

[7] This author having examined Cameron's type.

Callajoppa cirrogaster (Schrank), new combination[8]

1781. *Ichneumon cirrogaster* Schrank, Enum. Ins. Austr., p. 348.
1785. *Ichneumon crocatus* Fourcroy, Entom. Paris., II, p. 399.
1787. *Ichneumon lutorius* Fabricius, Mant. ins., I, p. 262.
1818. *Trogus lutorius* Gravenhorst, Nova acta acad. nat. curios., IX, p. 286.
1903. *Callajoppa bilineata* Cameron, Ent., XXXVI, p. 236.
1932. *Callajoppa lutoria* Uchida, Ins. Matsumurana, VII, p. 26.

Head brown, more or less marked with yellow before and black behind; antennae orange-fulvous, black at apex. Thorax black, subalar calli, upper margin of pronotum, collar, scutel and part of basal carinae, and postscutel more or less, yellow; tegulae and two longitudinal lines on scutum ferruginous; coxae, trochanters, and femora of four anterior legs more or less ferruginous, coxae usually black at base; hind coxae wholly black in the American specimens seen (European specimens vary from wholly ferruginous to wholly black), hind femora ferruginous with a longitudinal black mark behind; all tibiae fulvous, darker toward tip, tarsi fulvo-ferruginous. Abdomen wholly ferruginous with dark mark toward apex (European specimens may have abdomen wholly ferruginous or with black apex—variety *nigrocaudata*). Wings pale yellow, slightly infumated at tip. Length about 25 mm.

One male and one female from Toronto, Ontario, Canada, (A. Gibson); [Can].

The species is recorded as parasitic on *Papilio* and various sphingids by European authors.

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[8] In looking up certain references pertaining to *Trogus lutorius* (Fab.) as this species has generally been known to European workers, I noted with surprise in Dalla Torre's *Catalogus Hymenopterorum* that two prior names were given for the species. I looked up the names in the index expecting to find that this was as usual a case of the improper identification of the species names given, but found that these two names had apparently been given to the present species only. To check further on this matter I consulted Sherborn's *Index Animalium*, which only confirmed the evidence of Dalla Torre. I then consulted the original publications of these names and found that Schrank's name quite clearly referred to the species in question, and the use of the name *lutorius* was simply another case of the disregard of most European authors for Schrank in particular and for other authors prior to but differing from Fabricius and Gravenhorst. We are thus obliged to change, not only the name currently used for this genus, but also the name in use for its genotype.

GNAMPTOPELTA new genus[9]

(Figures 11, 12, 13.)

Trogus auct., ex parte.

Seems most nearly related to *Callajoppa* and *Catadelphus*, although in individual characters it shows resemblances to all our genera, even of the *Trogus* group. Differs from all the other North American genera of the *Catadelphus* group in the distinctly concave apical margin of the clypeus, without median projection.

Head about two and one-fourth to two and one-half times as wide as thick in dorsal aspect; cheeks and temples only moderately buccate, convergent caudad beyond the middle of their breadth, angle between cheeks and occiput subacute; cheeks about as broad as short diameter of eye, temples narrower. Head but little narrowed below in front view; malar space equal to basal width of mandible. Greatest width of clypeus as great as interocular line, three times height of clypeus, lateral margins strongly oblique, apical margin concave, simple (Fig. 11). Antennae lanceolate in female, weakly serrate in male.

Thorax with mesopleura about one and one-half times as high as wide; mesopleura and subalar calli not especially prominent. Declivous portion of pronotum nearest head vertical. Scutel from acute conical to subglobose with an obtuse dorsal point, margined briefly toward base, the anterior face not at all flattened. Slope of propodeum from areola to apex convex; areola a small polished boss, distinctly elevated above the costulae. Legs rather long in both sexes, hind tibia as long as femur plus trochanter, apex of hind femur exceeding middle of third tergum. Petiole strongly narrowed at base, considerably deeper than broad, gradually widening to the postpetiole, which is much less abruptly set off than in *Callajoppa* and *Conocalama*, with two dorsal carinae extending beyond the spiracles, the postpetiole only about two and one-half times as wide at apex as widest part of petiole and without elevation at the juncture. Incisures of abdomen rather strongly impressed (Fig. 12); terga densely reticulately punctate and opaque. Hypopygium of both sexes elliptical, as long as broad and as long as preceding sternum, nearly attaining apex of seventh tergum. Ovipositor sheaths scarcely exceeding apex of hypopygium; claspers as long as hypopygium, slightly tapering to apices. Aedeagus as represented in figure 10.

GENOTYPE: *Trogus obsidianator* Brullé.

Known to me only from two North American species.

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[9] γναμπτός, curved; πελτή, shield.

Key to the Species of Gnamptopelta

Head wholly black or with yellow orbits; thorax and abdomen wholly black.......................................*obsidianator* (Brullé)
Head and more or less of thorax ferruginous............*austrina* (Cresson)

Gnamptopelta obsidianator (Brullé), new combination

1846. *Trogus obsidianator* Brullé, Hist. nat. Ins. Hym., IV, p. 299.

Wholly black except four anterior tibiae and tarsi more or less fulvous, inner orbits sometimes yellow. Wings piceous with a yellowish reflection. Length 20 to 23 mm.

VERMONT: Bennington, [BS; 1]. St. Albans, [BS; 1].

MASSACHUSETTS: Boston, [BS; 1].

CONNECTICUT: Lyme, June 19, 1918, (Wm. Middleton), [US; 1].

NEW YORK: Bemus Point, June 26, 1937, July 20, 1937, July 29, 1937, (H. K. Townes), [Tow.; 3]. Ithaca, June 18, 1936, (H. K. Townes), [Tow.; 1]. Frontenac Point, Cayuga Lake, July 1-10, 1935, July 19, 1935, (J. G. Franclemont, [Tow.; 2]. Oak Orchard Swamp, Genesee County, July 7, 1934, (L. L. Pechuman), [Tow.; 1]. Shokan, July 8, 1936, (H. K. Townes), [Tow.; 2]. Poughkeepsie, July 6, 1936, July 25, 1936, (H. K. Townes), [Tow.; 2]. Millwood, June 28, 1936, (H. K. Townes), [Tow.; 3]. Westchester County, June 19, 1936, (H. K. Townes), [Tow.; 1]. Smithfields, Bear Mt. State Park, June 20, 1937, (L. L. Pechuman), [Tow.; 1]. Armonk, June 25, 1936, (H. K. Townes), [Tow.; 1]. Long Island, [US; 1].

NEW JERSEY: Anglesea, May 31, [ANS; 1]. Camden, July 26, 1891, [ANS; 1]. Cramer Hill, June 11, 1897, [ANS; 1]. Westville, June 19, 1897, [ANS; 1]. Moorestown, July 23, 1939, (H. K. Townes), [HPH; 1].

PENNSYLVANIA: Huntsville, June 16, 1934, (H. K. Townes), [Tow.; 1]. Greensburg, June 24, 1934, (D. H. Cross), [Tow.; 2]. Lehigh Gap, July 13, 1900, [ANS; 1]. July 3, 1897, [ANS; 1]; July 12, 1899, [ANS; 1]; July 2, 1897, [ANS; 1]. Highspire, July 18, 1909, (W. S. Fisher), [US; 1]. Inglenook, Dauphin County, June 20, 1909, (P. R. Myers), [US; 2]. Carlisle Junction, July 4, 1908, (P. R. Myers), [US; 1]. Pennypack Park, Philadelphia, June 29, 1937, (H. P. Hopper), [HPH; 2]; July 4, 1938, (H. P. Hopper), [HPH; 1].

MARYLAND: Cabin John, July 27, 1917, (E. L. Fouts), [US; 1]. Glen Echo, July 12, 1931, (J. C. Bridwell), [US; 1]. Shawan, June 30, 1932, (E. G. Fisher), [Tow.; 1].

DISTRICT OF COLUMBIA: Washington, June 15, 1934, (H. S. Barber), [US; 1].

VIRGINIA: Dixie Landing, May 27, (C. L. Marlatt), [US; 1]. Paeonian Springs, June 1908, (S. A. Rohwer), [US; 1].

GEORGIA: No other data, [ANS; 4].

LOUISIANA: New Orleans, July, [US; 2].

OHIO: Put-in-Bay, July 1-10, 192–, "S. Bass I.", [US; 1]; Put-in-Bay, July 13, 1922, [US; 1]. Summit County, (L. J. Lipovsky), [Kans; 2].

INDIANA: No other data, (C. F. Baker), [US; 1]. Vincennes, June 29, 1924, (B. A. Porter), [US; 1].

ILLINOIS: No other data, [ANS; 2]. "Northern Illinois", [ANS; 1]; [Ill; 2]. Oak Grove, June 26, 1885, (no. 6177), [Ill; 1]. Prosper Hill, June 29, 1905, [Ill; 1]. Oakwood, June 18, 1926, (Frison and Hayes), [Ill; 1]. Urbana, June 20, 1915, [Ill; 2]. Normal, July 1882, [Ill; 1]. Kanakee, July 10, 1925, (T. H. Frison), [Ill; 1]. Algonquin, (Nason), [Ill; 1].

MICHIGAN: Agricultural College, (C. F. Baker), [US; 1]. Grand Rapids, [ANS; 1]. Cheboygan County, July 18, 1932, (H. B. Hungerford), [Kans; 1].

MISSOURI: Overland, June 19, 1935, (B. H. Pickel), [Tow.; 1].

KANSAS: Riley County, (Popenoe), [US; 1]. Lyons County, June 18, 1923, (R. H. Beamer), [Kans; 1]. Coffey County, June 19, 1923, (Clarence Bare), [Kans; 1]. Johnson County, 1915, (R. H. Beamer), [Kans; 1].

NEW MEXICO: Las Vegas N. H, (Barber and Schwarz), [US; 1].

CANADA: Ontario, July 1895, [US; 1].

Gnamptopelta austrina (Cresson), new combination

1869. *Trogus austrinus* Cresson, Trans. Amer. Ent. Soc., II, p. 92.

Mostly black; head, prothorax, mesothorax, sometimes scutel, upper surface of propodeum, and part of first abdominal segment, fulvo-ferruginous. Anterior legs and mid tibiae and tarsi fulvous. Antennae orange-fulvous, apices sometimes darkened. Wings piceous with golden gloss. Length, about 21 mm.

SOUTH CAROLINA: Horry County, July 3, 1932, (H. K. Townes), [Tow.; 1].

GEORGIA: No other data, [ANS; 2 *paratypes*, 1 other].

FLORIDA: No other data, [US; 1]; June 1, 1895, [ANS; 1]; June 26, 1895, [ANS; 1]. Capron, March 30, [ANS; *type*]. Indian River, [ANS; 1]. Royal Palm State Park, March 1933, (F. M. Jones), [ANS; 1]. St. Petersburg, V [= May?], (J. Doll), [US; 1]. Big Bayou, March 15, 1923, (E. M. Craighead), [US; 1]. Gainesville, May 23, 1919, (P. W. Fattig), [US; 1]. Fort Mead, August 13, 1930, (L. D. Tuthill), [Kans; 1]. Arcadia, April 10, 1937, (J. G. Franclemont), [Tow.; 1]. Maitland, April 4, 1929, (H. K. Townes), [Tow.; 1]. Enterprise, March 1923, [Tow. Ohio; 1].

TRICYPHUS Kriechbaumer

(Figures 14, 15, 16)

1898. *Tricyphus* Kriechbaumer, Berl. Ent. Zeitschr., XLIII, p. 23.

1898. *Tricyphus* Kriechbaumer, Ent. Nachr., XXIV, pp. 4, 30. [Genotype: *Tricyphus cuspidiger* Kriechbaumer.]

This genus was originally described only in a key which will not separate it from *Callajoppa,* with which Ashmead, Morley, and others have consequently considered it to be identical. Yet it seems clear from the few characters given of the species (all new) which Kriechbaumer placed in this genus and from their neotropical habitat that *Callajoppa* (under the name *Trogus*) was considered by Kriechbaumer not to belong to the group according to his concept and that in *Tricyphus* we have to do with a distinct genus. The present author has seen no specimens of any of Kriechbaumer's species; but Szépligeti has described a species of this genus from our area, which species is rather readily recognizable, and the concept of the genus *Tricyphus* used in this paper is based on the author's determination of Szépligeti's species, on the assumption (supported by color characters) that the latter author had a first hand knowledge of Kriechbaumer's genus.

Head seen from above about twice as wide as long, only moderately buccate, cheeks and temples somewhat convergent behind anterior third and only about two-thirds of short diameter of eye, angle with occiput almost a right angle; head distinctly narrowed below in front view, approaching in this respect more nearly to *Trogus* than to any of the other genera of the *Catadelphus* group. Clypeus twice as wide as high, base about as wide as interocular distance at base of antennae, apical margin much narrower (about three-fourths width of base), straight, not strongly separated from face at base, lateral margins very oblique, angles rather broadly rounded (Fig. 14). Inner margins of eyes usually slightly divergent below, face divided into three longitudinal parts by two rather strong impressions. Labrum strongly exserted; mandibles somewhat strongly narrowed toward apex, lower tooth well developed but smaller than upper. First joint of flagel four times as long as thick at apex, as long as scape plus pedicel, one and one-half times as long as second joint.

Thorax about one and one-third times as deep as broad, declivous portion of pronotum near head slightly overhanging; subalar calli and mesopleura rather prominent; notauli wanting. Scutel strongly elevated, four-sided, wedge-shaped, the summit transverse and the anterior, lateral, and posterior faces flat. Propodeum with posterior face weakly convex; areola a rather prominent, polished boss; areae dentiparae and petiolarea rather coarsely rugose-reticulate.

Postpetiole very little shorter than petiole and over three times as wide, triangular, and without basal elevation. Abdomen exclusive of first tergum about as long as head and thorax together, about three times as long as wide, terga behind the second transverse. Hypopygium longer than the preceding sternum, semi-elliptical, slightly broader in female. Claspers longer than broad, rather strongly tapering, and narrowly truncate at apex. Aedeagus as in figure 16.

Hind tibia longer than hind femur and trochanter together, apex of hind femur reaching apex of third tergum. Areolet short petiolate, triangular, differing from all the other genera of the *Catadelphus* group in having the second cubital side very short and second intercubitus one and one-half times as long as the first.

The distribution known to me consists of Brazil from which Kriechbaumer's species were described, and eastern and central North America, west to Ontario and Kansas.

Key to Species and Subspecies of Tricyphus

1. Thorax and abdomen wholly black....................*ater* new species
   Abdomen more or less red or brown..................................2
2. Body brown 3
   Body black except apex of abdomen (or rarely, entire abdomen) red. *apicalis* (Cresson)
3. Wings wholly fuscous ....*elegans vulpinus* Szépligeti
   Wings with clear spot beyond middle, at least in hind wing, or more often yellowish-hyaline with fuscous band before stigma and at apex. *elegans elegans* (Cresson)

Tricyphus elegans (Cresson), new combination

Wholly ferruginous, with three longitudinal marks on mesonotum and tips of antennae and mandibles dark and with labrum, broad inner orbits, and four anterior tibiae in part, yellow. Length, about 19 mm.

Tricyphus elegans elegans (Cresson)

1869. *Trogus elegans* Cresson, Trans. Amer. Ent. Soc., II, p. 94.

Differs from the more widely distributed southern form *vulpinus* only in having more or less of the wings yellowish-hyaline.

MAINE: No other data, [ANS; *type*].

MASSACHUSETTS: Springfield, (Anna Dimmock), [US; 1]. West Springfield, (George Dimmock; no. 1637), [US; 1]. ? (no data), [BS; 1].

CONNECTICUT: Lyme, July 22, 1918, (W. S. Fisher), [US; 1].

NEW YORK: Oswego, July 16, 1895, [US; 1]. Buffalo, (E. P. VanDuzee), [Cal; 1]. Ithaca, July 22, 1934, (H. K. Townes), [Tow.; 1]; July 21, 1894, [Tow. CU; 1]. Westchester County, July 31, 1936, (H. K. Townes), [Tow.; 1].

Illinois: Urbana, September 1930, [Ill; 1].
Quebec: Aylmer, July 27, 1924, (E. B. Watson), [Can; 1].
Ontario: Rosebank, August 1904, [Can; 1]. Ridgway, July 24, 1910, (M. C. VanDuzee), [Cal. 1]. Toronto, [ANS; 1].

Tricyphus elegans vulpinus Szépligeti

1900. *Tricyphus vulpinus* Szépligeti, Termész. Füzet., xxiii, p. 288.

Differs from the subspecies *elegans* only in the wholly dark wings. The specimen recorded below from Harrisburg, Pa., has the mesopleura mostly black.

Massachusetts: Springfield, (Anna Dimmock), [US; 1].
New York: Elmira, August 4, 1937, (H. K. Townes), [Tow.; 1].
New Jersey: Wildwood, June 17, 1935, (L. J. Bottimer), [HPH; 1].
Pennsylvania: Harrisburg, July 1921, (J. N. Knull), [US; 1]. Carlisle Junction, August 28, 1909, (W. S. Fisher), [US, 1]. Buena Vista, September 7, 1935, September 12, 1935, (R. H. McCauley, Jr.), [Tow.; 2].
Maryland: Plummer's Island, September 1919, (H. S. Barber), [US; 1]. Glen Echo, (R. M. Fouts), [US; 1].
Virginia: Roslyn, (H. H. Smith), [US; 1]. Falls Church, July 1928, [Kans; 1].
North Carolina: Cedar Mt., August 20, 1930, (H. K. Townes), [Tow.; 1].
Illinois: Central Illinois, [ANS; 1]. Northern Illinois, [ANS; 1] [Ill; 1]. Hillsboro, September 7, 1902, (Ross and Mohr), [Ill; 1].
Kansas: Leavenworth County, June 30, 1924, (R. H. Beamer), [Kans; 1].
Ontario: Windsor, 1891, [Can; 1].
Data faulty: ♀ no data, (E. B. Southwick), [ANS; 1]. (No. 1525 Dimmock Ent. notes; ex *Darapsa myron*), [US; 1].

Tricyphus apicalis (Cresson), new combination[10]

1877. *Trogus apicalis* Cresson, Trans. Amer. Ent. Soc., vi, p. 197.

Black with inner orbits and four anterior tibiae marked with yellow, the abdomen beyond the second or third tergum (in one specimen, beyond the petiole) rufous. Wings wholly dark fuscous (with a clear spot in hind wings in one specimen).

Vermont: Mt. Ascutney, July 11, 1908, (C. W. Johnson), [US; 1].
Pennsylvania: Lehigh Gap, July 14, 1899, [ANS; 1].
Virginia: Nelson County, August 2, 1927, (W. Robinson), [US; 1].
Georgia: No other data, (Morrison), [ANS; *type*].
Ohio: Bellefontaine, October 12, 1917, [Tow. CU; 1].

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[10] If the species which I have placed in the genus *Tricyphus* belong there, and if *Tricyphus apicalis* Kriechb. 1898 is distinct from his other species, this latter will have to be renamed.

ILLINOIS: Urbana, June 13, 1885, [Ill; 1]. Danville, July 16, 1930, (Frison and Hottes), [Ill; 1]. Chicago, (Shelford), [Ill; 1].

MICHIGAN: Midland County, July 23, 1938, (R. R. Dreisbach), [Tow.; 1, det. H. P. Hopper]; [Tow. Dreisbach; 1].

Tricyphus ater new species

Most closely related to *apicalis* (Cress.), from which it differs only in the wholly black abdomen.

Male. Length, 20 mm.; forewing 20 mm.; antennae about 12 mm. (tips wanting).

Black; the following yellowish-white to yellow; lateral areas of face, short line on anterior orbits, labrum, fore and mid tibiae, tarsi, and knees, second sternum except at sides, and apical margins of third and following sterna. Borders of sutures of thorax fuscous; outer side of fore and mid femora whitish.

Antennae setiform, with more than thirty-seven joints (tips wanting), with twenty-five sense-organs. Eyes subglobose, inner margins slightly converging below.

Scutel strongly elevated, pyramidal, the anterior face somewhat shorter than the posterior. Propodeum with basal lateral and basal areas confluent.

Petiole at base slightly broader than deep, at middle one-third width of apex of postpetiole and slightly deeper than broad; spiracles about one third of total length of segment from apex. Gastrocoeli rather shallow. Aedeagus as figured for the genus.

Head rather finely punctate and polished. Thorax more closely puncture and subpolished. Abdomen very closely punctured and subopaque, segments beyond the third successively more sparsely punctured and more shining.

Type.—Male; Oakwood, Illinois; July 6, 1930; (H. H. Ross); [collection of Illinois State Natural History Survey].

CATADELPHUS Wesmael

(Figures 17, 18)

1854. *Catadelphus* Wesmael, Bull. Acad. Sci. Belg., annexe, p. 134. [Genotype: *Ichneumon arrogator* Fabricius.]

Hitherto no North American species has been placed in this genus. In the present paper three of Cresson's species and one new species are placed in *Catadelphus*. Our species fall into two groups based on color and form of mandibles, as indicated in the key. The genotype belongs to the group here called the *atrox* group in the features mentioned, but differs from all the North American species in the form of the first tergum.

Head strongly buccate, cheeks divergent caudad for a distance equal to short diameter of eye and the rather abruptly convergent for about two-thirds that distance; head rather large, rather shallowly excavated behind; the angle between cheeks and occiput obtuse; vertex slightly convex (so that stemmaticum is raised slightly above apex of eyes in contrast to its lower position in other genera). Clypeus as wide as face, about twice as wide as high, indistinctly separated from face; apical margin as broad as basal or nearly, straight or very slightly convex, simple; lateral margins parallel or nearly, angles subacute (Fig. 17). Antennae rather short, about as long as head, thorax, and first abdominal segment together; first joint of flagel three times as long as thick, longer than scape and pedicel together, nearly as long as the two following joints together. Labrum very weakly exserted in *arrogator* and the *atrox* group (some specimens have it concealed by a slight deflection, in which case a slight gap may be perceived between the mandibles and the clypeus, through which the labrum may be seen), more prominent in *buccatus* (Cress.), which also differs in having the mandibles unidentate, subacute or somewhat blunt, rarely with a slight hump in the position of the lower tooth; in the *atrox* group and *arrogator* the mandibles are bidentate with lower tooth much weaker and somewhat distant from apex.

Thorax about one and one-half times as deep as broad. Notauli present in anterior one-fourth of mesonotum, weak to obsolete. Scutel moderately strongly elevated, but less so than in most of our genera; distinctly margined at sides above in basal third or more, the carinae merging into a distinct though rounded angle extending to apex (rarely the carinae present only a little beyond base, the sides being nevertheless flattened and separated from dorsal surface by a distinct rounded angle); upper surface narrower at apex than at base. Propodeum rather coarsely confluently punctate above, completely or almost completely areolated, the basal abscissae of the median longitudinal carinae weak or obsolete; costulae weak; areola small, with distinct central opening; posterior face of propodeum with a swelling curve from areola to paracostulae, steeply declivous and somewhat concave behind.

Wings comparatively short; areolet rather large, narrowly subsessile, the two cubital sides equal, much shorter than the intercubiti which are likewise equal. Hind legs long and stout, tibia as long as femur and trochanter together, apex of femur about attaining apex of third tergum.

First abdominal segment rather broad and depressed at base, petiole deeper than broad at middle, about one and one-half times as long as postpetiole, the latter triangular and about three and one-half times as broad at apex as petiole, trilobate-sinuate at apex, central area faintly separated from the lateral, carinae wanting on postpetiole. Gastrocoeli rather sharply, not deeply, impressed, slightly broader than long. Abdomen beyond first segment about as long as head and thorax together; second tergum from nearly quadrate to slightly wider than long in our species, following terga wider than long and successively shorter caudad. Apex of abdomen in female distinctly broader than deep (in the other North American genera of the *Catadelphus* group the apex in female is about as deep as broad); hypopygium broader than long, semi-elliptic, not longer than the preceding sternum, not attaining apex of sixth tergum; ovipositor barely reaching apex of seventh tergum. Claspers with edges rather strongly convergent to the somewhat narrowly truncate apex. Aedeagus as in figure 18.

Body very finely, moderately closely punctate, subopaque in *atrox* group, weakly shining in *arrogator* and *buccatus*, especially the latter.

Distribution known to me: Central and Southern Europe, Japan, North American west of the Mississippi River.

Key to the Species of Catadelphus

1. Mandibles simple; body ferruginous (brown), male more or less marked with black.......................................*buccatus* (Cresson)
   Mandibles bidentate; head and thorax black (atrox group)............2
2. Wings yellow, fuscous at tip; abdomen black, second tergum sometimes dull rufo-ferruginous........................*marginipennis* (Cresson)
   Wings fuscous...3
3. Abdomen black, often with rufo-ferruginous spot on second tergum. *atrox* (Cresson)
   Abdomen except petiole rufous..................*semiruber* new species

Buccatus group

Catadelphus buccatus (Cresson), new combination

1877. *Trogus buccatus* Cresson, Trans. Amer. Ent. Soc., vi, p. 199.

Female. Wholly ferruginous; wings usually fuscous.[11] Tips of antennae and base of scutel may be black.

Male. Ferruginous; head, thorax, and abdomen with black spots and bands, the thorax largely black.

Length, 18 mm.; antennae 12 mm.; forewing ♀ 14 mm., ♂ 15 mm.

NEVADA: No other data, [ANS; 5].

WASHINGTON: Spokane, (C. V. Piper), [US; 1].

CALIFORNIA: Dunsmuir, (Wickham), [US; 1]. San Bernardino County, May, (Coquillett), [US; 1]. Berkeley, April 18, 1915, (C. L. Fox), [Cal; 1].

BRITISH COLUMBIA: Vancouver Island, [ANS; *type* and 1 *paratype*]. Victoria, (no. 71), [US; 1].

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[11] Yellowish-hyaline in the paratype and in the specimen in the collection of the California Academy of Sciences.

Atrox group

Catadelphus atrox (Cresson), new combination

1869. *Trogus atrox* Cresson, Trans. Amer. Ent. Soc., II, p. 93.

Black, sometimes with an obscure bluish tinge, especially in greasy specimens, second tergum with a broad transverse rufo-ferruginous spot (sometimes absent). Wings dark fuscous, stigma ferruginous. Length, about 18 mm.

TEXAS: Central Texas, (ex *Pogocolon juanita* Strecker), (George Franck), [US; 1]. Hockley, (no. 37), [US; 1].

DAKOTA TERRITORY: No other data, [ANS; *type*].

SOUTH DAKOTA: Piedmont, [ANS; 1]. Camp Crook, August 1, 1924, (M.), [US; 1].

KANSAS: No other data, (F. H. Snow), [ANS; 1]. Clark County, June, 1960 ft., (F. H. Snow), [ANS; 1]. Wallace County, 3000 ft., (F. H. Snow; no. 192), [US; 1]. Clark County, June, (F. H. Snow), [Kans; 1]. Hamilton County, [Kans; 1]. Cheyenne County, (F. X. Williams), [Kans; 1].

MONTANA: No other data, [ANS; 2].

COLORADO: No other data, (C. F. Baker; no. 1656), [US; 1]. Platte Cañon, July, (F. M. Schott), [US; 1].

NEW MEXICO: No other data, (T. Pergande), [US; 1].

CALIFORNIA: Mt. Diablo, April 21, 1934, (G. E. and R. M. Bohart), [US; 1].

Catadelphus marginipennis (Cresson), new combination

1869. *Trogus marginipennis* Cresson, Trans Amer. Ent. Soc., II. p. 93.

Differs from *atrox* chiefly in having the wings yellow with fuscous tips. The second tergum is somewhat less likely to have the ferruginous spot than in the preceding species. Length, about 18 mm.

DAKOTA TERRITORY: No other data, [ANS; *type* and 1 *paratype*].

KANSAS: No other data, (F. H. Snow), [ANS; 1]. Clark County, June, 1960 ft., (F. H. Snow), [ANS; 1]; June, (F. H. Snow), [Kans; 3]. Hamilton County, 3350 ft., (F. H. Snow), [Kans; 1].

NEW MEXICO: Cimarron, August 17-22, 1914, (W. R. Walton), [US; 1].

Catadelphus semiruber new species

Quite distinct from any of the other species known to me in the abdomen being entirely red except the petiole. Nearest in color to *arrogator* (Fab.), which has the apex of the abdomen black and further differs from all the American species in having the dorsal carinae of the petiole continued strongly on the postpetiole nearly to apex and in having the gastrocoeli not broader than long.

Female. Length, 22 mm.; forewing 16 mm.; antennae 12 mm.

Head, thorax, and legs black; antennae piceous; mandibles, margins of clypeus, tibiae and tarsi of forelegs, fusco-piceous. Petiole of abdomen black; postpetiole and remainder of abdomen rufous. Wings dark fuscous without violaceous reflection, veins darker, stigma ferruginous.

Antennae setiform, flattened beneath and slightly broadened in apical two-fifths, the flattened portion more densely pubescent than the remainder. Head about twice as broad as long in dorsal view. Eyes subglobose, inner margins subparallel and slightly sinuate. Face nearly twice as long as broad; anterior margin of clypeus nearly straight, slightly convex; malar space subequal to basal width of mandible.

Scutel with sides and posterior face nearly vertical, distinctly margined laterally on entire superior surface, the juncture between the superior and posterior faces rather broadly rounded; upper surface about two-thirds as wide at apex as at base; postscutel slightly elevated. Propodeum completely areolated, the costulae and basal abscissae of longitudinal median carinae rather weak.

Petiole with sides convergent to juncture with postpetiole, broader than deep at extreme base and nearly twice as deep as broad at middle; apex of postpetiole about four times as broad as petiole at middle of segment. Second abdominal tergum about three-fifths as broad at base as apex, slightly longer than greatest width.

Head rather closely moderately strongly punctate, the punctures on face larger than the interspaces, smaller on cheeks and temples but the distance between their centers about the same as on face. Mesonotum very finely, closely punctate, almost coriaceous, the pleura and scutels more coarsely and separately punctate. Propodeum basally and entire metapleura reticulately punctate, appearing scabrous, becoming rugose posteriorly on the propodeum. Abdomen coriaceous, very finely closely punctate.

Type.—Female; " Nip. J. F."; [Nipigon, Ont., James Fletcher]. [Collection of the Division of Entomology, Department of Agriculture, Canada].

. *Paratype.*—Female; same data; [Collection of the Academy of Natural Sciences of Philadelphia].

SPECIES NOR RECOGNIZED

Trogus atrocaeruleus Cresson. The type of this species unfortunately appears to be lost. So far as can be determined from the description it does not belong in the tribe Trogini, being perhaps a species of *Coelichneumon*, judging from the greenish-blue coloration.

SPECIES INCORRECTLY PLACED IN TROGUS

Trogus flavipes Cresson, removed to *Hoplismenus* by Cresson.

Trogus provancheri Burque, synonymized with *Amblyteles expunctatus* (Cresson) by Provancher on Cresson's identification.

Trogus pulcherrimus Ashmead listed as from California by Dalla Torre, was originally described from Baja California, Mexico.

LIST OF RECORDED HOSTS OF TROGINI [12]

Ampelophaga sp.	*Conocalama nubilipennis* (Hald.).
Ampelophaga myron Cr.	*Tricyphus elegans vulpinus* Szépl.
(*Darapsa*) see *Ampelophaga*.	
Dolba hylaeus Dru.	*Conocalama brullei* (Cr.) [Conn.].
(*Hyloicus*) see *Sphinx*.	
Isia isabella S. & A.[13]	*Conocalama nubilipennis* (Hald.) [N.J].
Paonias astylus Dru.	*Conocalama brullei* (Cr.) [Conn.].
Paonias myops S. & A.	*Conocalama brullei* (Cr.).
	Conocalama copei (Cr.).
	C. copei var. *nigrocincta* (Hasey).
Papilio sp.	*Trogus vulpinus* Grav.
	Trogus edwardsii Cr.
(*Papilio ajax*) see *marcellus*.	
Papilio asterias Cr. (*polyxenes* var.)	*Conocalama nubilipennis* (Hald.) [N.J.].
	Trogus vulpinus Grav.
Papilio eurymedon	*Trogus vulpinus* Grav.
Papilio glaucus L.	*Trogus fulvipes* Cr.
	Trogus vulpinus Grav.

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[12] A search for host records of Trogini in the literature was not made. There have been several general publications in which such information might be found, as well as doubtless some scattered records. The records here are only from the material studied plus the New York check-list (NY), Connecticut list (Conn.), New Jersey check-list (NJ), and U. S. Department of Agriculture Miscellaneous Publication no. 183: "Macrolepidoptera and their parasites reared from field collections in the northeastern part of the United States" by Schaffner and Griswold (S&G). Unless followed by an indication of their source, records are from the material studied.

[13] This record appears dubious, since all other records for the *Catadelphus* group are exclusively from sphingids and *Papilio*.

Papilio marcellus Cr.	*Trogus vulpinus* Grav. [S&G].
Papilio polyxenes Fab.	*Gnamptopelta obsidianator* (Br.) [N.Y.].
Papilio rutulus	*Trogus vulpinus* Grav. [Tow.].
Papilio troilus L.	*Trogus vulpinus* Grav. [S&G].
(*Papilio turnus* L.) see *glaucus*.	
Papilio zelicaon	*Trogus vulpinus* Grav.
(*Pogocolon*) see *Proserpinus*.	
Proserpinus juanita Stkr.	*Catadelphus atrox* (Cr.).
(*Pyrrharctia*) see *Isia*	
(*Smerinthus*) see *Paonias*.	
Sphecodina abbottii Swains.	*Conocalama nubilipennis* (Hald.).
Sphingid	*Conocalama brullei* (Cr.) [N.Y.]. *Conocalama copei* (Cr.) [S&G].
Sphingid larvae[14]	*Conocalama brullei* (Cr.) [N.J.].
Sphinx kalmiae S. & A.	*Tricyphus apicalis* (Cr.) [S&G].
Vanessa cardui L.	*Trogus vulpinus* Grav.

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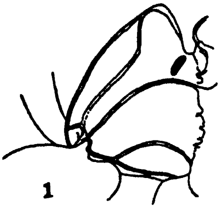
[14] This record is probably erroneous; for all Ichneumoninae are generally supposed to issue from the pupa of the host.

EXPLANATION OF FIGURES

PLATE XIX

Fig. 1.—*Trogus vulpinus* Grav., propodeum, dextrolateral aspect.
Fig. 2.—*Trogus vulpinus* Grav., head from above.
Fig. 3.—*Trogus vulpinus* Grav., abdomen from above: a) female, b) male.
Fig. 4.—*Conocalama (Tmetogaster) nubilipennis* (Hald.), head from above.
Fig. 5.—*Conocalama (Tmetogaster) nubilipennis* (Hald.), anterior view of head.
Fig. 6.—*Conocalama (Tmetogaster) nubilipennis* (Hald.), aedeagus, a) dextrolateral aspect, b) dorsal aspect.
Fig. 7.—*Conocalama (Conocalama) occidentalis* var. *luteata* new variety, anterior view of head.
Fig. 8.—*Conocalama (Conocalama) occidentalis* var. *luteata* new variety, first abdominal segment, sinistrolateral aspect.
Fig. 9.—*Conocalama (Conocalama) occidentalis* var. *luteata* new variety, aedeagus, a) dextrolateral aspect, b) dorsal aspect.
Fig. 10.—*Callajoppa cirrogaster* (Schrank), aedeagus, a) dextrolateral aspect, b) dorsal aspect.
Fig. 11.—*Gnamptopelta obsidianator* (Br.), anterior view of head.
Fig. 12.—*Gnamptopelta obsidianator* (Br.), abdomen of female from above.
Fig. 13.—*Gnamptopelta obsidianator* (Br.), aedaegus, a) dextrolateral aspect. b) dorsal aspect.
Fig. 14.—*Tricyphus elegans vulpinus* Szépl., anterior view of head.
Fig. 15.—*Tricyphus elegans vulpinus* Szépl., first abdominal segment, sinistrolateral aspect.
Fig. 16.—*Tricyphus elegans vulpinus* Szépl., aedaegus, a) dextrolateral aspect. b) dorsal aspect.
Fig. 17.—*Catadelphus atrox* (Cress.), anterior view of head.
Fig. 18.—*Catadelphus atrox* (Cress.), aedaegus, a) dextrolateral aspect, b) dorsal aspect.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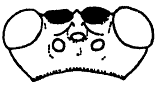
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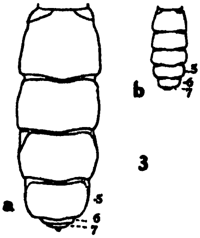

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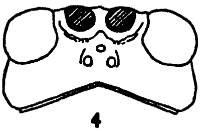
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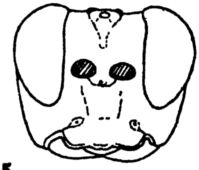
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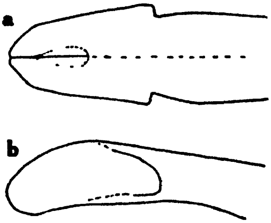

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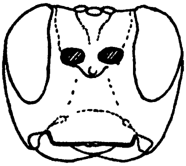
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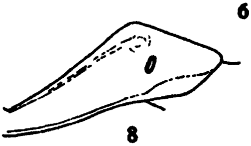
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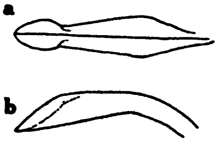

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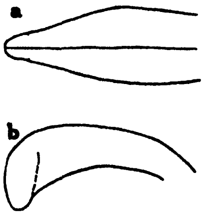

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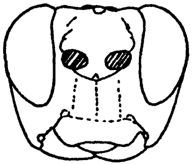
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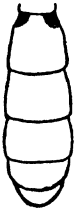
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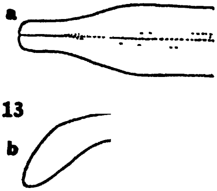

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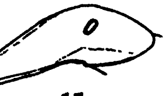
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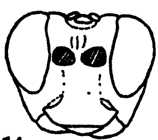
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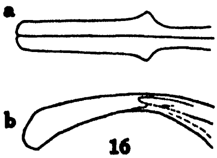

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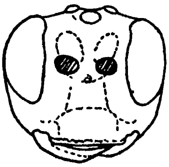
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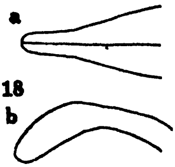

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HOPPER—AMERICAN TROGINI

A REVISION OF THE GENUS NEOLARRA

(HYMENOPTERA: NOMADIDAE)[1]

BY CHARLES D. MICHENER

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(Text-figures)

Neolarra is a small genus of minute parasitic bees, widely distributed over western North America and extending as far east as Tennessee. Specimens are usually found in arid, sandy regions, where they commonly fly in an erratic manner over the surface of the soil, their gray color and small size making them most inconspicuous. More rarely they may be seen visiting flowers. I have never collected them when some species of *Perdita* was not abundant nearby, and considering the probabilities from the standpoint of size, it seems likely that *Neolarra* is an inquiline in the nests of *Perdita,* a conclusion already reached by Timberlake, and published by Cockerell.[2]

Although *Neolarra* was originally described by Ashmead as a wasp, and was so considered by Fox, Baker in 1896 showed it to be a bee. In 1895 Cockerell described the genus *Phileremulus,* not recognizing its affinity with *Neolarra,* which was still regarded as a wasp. *Phileremulus* has since been considered as a distinct genus, differing from *Neolarra* in lacking the second transverse cubital and the second recurrent veins, and in having five-segmented instead of six-segmented maxillary palpi.[3] However,

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[1] This the second of a series of papers on North American Nomadidae. For the first, in which the various genera are described, see these Transactions, present volume, pp. 265-305.

[2] Cockerell, T. D. A., Some California parasitic bees, *Pan-Pac. Ent.,* v, p. 104, 1929.

[3] Cockerell, T. D. A. and E. Atkins, On some genera of bees, *Ann. Mag. Nat. Hist.,* (7), IX, p. 232, 1902.

the maxillary palpi are apparently five-segmented (not counting the basal tubercle) in both groups. Furthermore, the wing venation is variable, as pointed out by Cockerell.[2] Frequently small accessory veins are present, and sometimes some of the normal veins are obliterated or reduced to mere stubs. Some specimens of *Neolarra californica* have, except for a minute stub, the venation of *Phileremulus*. It seems, therefore, that these characters are not of generic value. I have, however, retained the name *Phileremulus* as a subgenus for a group of species with produced axillae, as indicated below. With one exception all the species normally having only one transverse cubital and one recurrent vein have also produced axillae, and belong to *Phileremulus* as here defined.

Certain paratypes and other material on which this paper is based have been deposited in the collection of the American Entomological Society.

Key to the Subgenera of Neolarra

Axillae short and rounded; scutellum widest immediately behind axillae (Figs. 2 and 3) ....*Neolarra* s str.

Axillae produced and angular; scutellum widest behind middle (Fig. 1). *Phileremulus*

Subgenus **NEOLARRA** Ashmead

Neolarra Ashmead, Colo. Biol. Assn. Bull., I, p. 8, 1890. Fox, Ent. News, IV, p. 292, 1893. Baker, Proc. Ent. Soc. Wash., IV, p. 20, 1896. Ashmead, Trans. Am. Ent. Soc., XXVI, p. 81, 1899. Cockerell and Robbins, Univ. Colo. Stud., VII, p. 183, 190, 1910. Crawford, Ins. Insc. Mens., IV, p. 136, 1916.

Axillae rounded; scutellum widest immediately behind axillae; two recurrent veins and two transverse cubital veins present (except in *N. linsleyi* and a few specimens of other species).

ORTHOTYPE: *Neolarra pruinosa* Ashmead.

Key to the species of the Subgenus Neolarra

Males

1. First segment of flagellum longer than broad and longer than pedicel..2
First segment of flagellum broader than long or about as long as broad, shorter than pedicel (in *vandykei* about as long as pedicel and longer than broad)..4

2. Distance from median ocellus to posterior edge of vertex half distance from median ocellus to bases of antennae; red of abdomen very dark..*helianthi*

Distance from median ocellus to posterior edge of vertex over half distance from median ocellus to bases of antennae; red of abdomen lighter...3

3. Process of metanotum considerably narrower than half width of scutellum..................................*congregata*

Process of metanotum almost as broad as half width of scutellum. *abdominalis*

4. One recurrent vein and one transverse cubital vein; axillae narrowly arcuate (figure 2)..................................*linsleyi*

Two recurrent veins and two transverse cubital veins; axillae broadly arcuate..5

5. First segment of flagellum fully as long as pedicel and longer than broad...*vandykei*

First segment of flagellum shorter than pedicel and broader than long..6

6 Axillae more narrowly arcuate than in figure 3; process of seventh tergite narrow (about as in figure 8)..................*pruinosa*

Axillae broadly arcuate as in figure three.....................7

7. Process of seventh tergite broad, about as in figure 10..........*alba*

Process of seventh tergite slender, about as in figure 8 ..*californica*

Females

1. First segment of flagellum longer than broad and longer than pedicel..2

First segment of flagellum broader than long or about as long as broad, shorter than pedicel.......................................4

2. Apical margin of fifth tergite with a deep median notch.....*verbesinae*

Apical margin of fifth tergite hardly emarginate....................3

3. Process of metanotum half as wide as scutellum........*abdominalis*

Process of metanotum less than half as wide as scutellum ...*congregata*

4. Posterior margin of fifth tergite nearly straight or with broad, shallow, median emargination...................................5

Posterior margin of fifth tergite with deep, median notch.............7

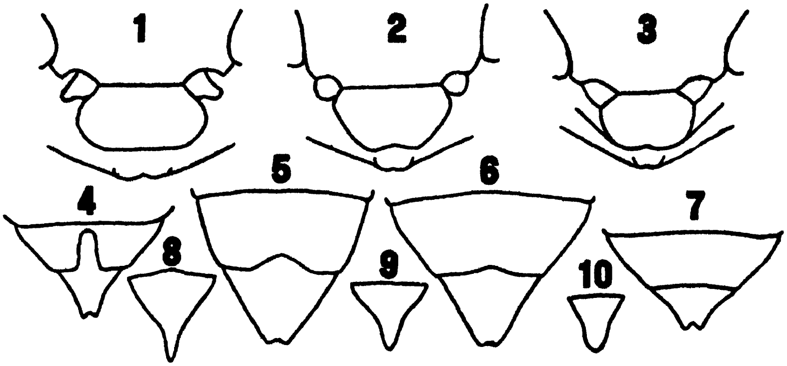
5: Two recurrent and two transverse cubital veins; margin of fifth tergite with broad, median emargination..............................6

One recurrent and one transverse cubital vein; posterior margin of fifth tergite nearly straight................................*linsleyi*

6. Prothoracic tubercles large, thorax fully as broad across the tubercles as across the mesepisterna; legs almost entirely red............*pruinosa*

Prothoracic tubercles smaller, thorax narrower across the tubercles than across the mesepisterna; femora mostly black.............*vandykei*

7. Larger, robust species with abdominal pubescence so dense that the red integumentary color hardly shows through.......................*alba*
Smaller, slender species, with pubescence less dense, the red showing conspicuously on basal parts of tergites..................*californica*



Explanation of text-figures.—1 -Dorsal view of posterior part of thorax of *Neolarra* (*Phileremulus*) *coloradensis* Michener. 2.-Dorsal view of posterior part of thorax of *Neolarra* (*Neolarra*) *linsleyi* Michener. 3 -Dorsal view of posterior part of thorax of *Neolarra* (*Neolarra*) *californica* Michener. 4.-Fifth and sixth tergites of *Neolarra* (*Neolarra*) *alba* Cockerell, female. 5.-Fifth and sixth tergites of *Neolarra* (*Neolarra*) *pruinosa* Ashmead, female. 6 -Fifth and sixth tergites of *Neolarra* (*Neolarra*) *abdominalis* Michener, female. 7 -Fifth and sixth tergites of *Neolarra* (*Neolarra*) *linsleyi* Michener, female. 8.-Seventh tergite of *Neolarra* (*Phileremulus*) *coloradensis* Michener, male. 9.-Seventh tergite of *Neolarra* (*Neolarra*) *vandykei* Michener, male. 10 -Seventh tergite of *Neolarra* (*Phileremulus*) *mallochi* (Crawford), male.

Neolarra (Neolarra) helianthi (Cockerell)

Neolarra congregata helianthi Cockerell, Am. Mus. Novit., No. 831, p. 5, 1936. (♂).

This is a large species with dark red abdomen, closely related to and difficult to distinguish from both *verbesinae* and *congregata*. The abdomen is darker than in either of these species, and the face is broader and the size larger than in *congregata*. I have here regarded *helianthi* as a distinct species because it appears to be as different from its relatives as many other forms regarded as species. Since only the type specimen is known, it is perhaps impossible to determine the true status of this form at the present time.

Male. Head: Distance from median ocellus to posterior edge of vertex about half distance from median ocellus to bases of antennae; flagellum black above, dusky beneath; first segment of flagellum longer than broad and longer than pedicel; labrum black. Thorax: Wings with two recurrent and two transverse cubital veins. Abdomen: Dark red, apical margins of tergites one to six with white pubescent fasciae. Length, nearly 6 mm.

Type.—Male; White Rocks, near Boulder, Colorado; [Am. Mus. Nat. Hist.].

Neolarra (Neolarra) verbesinae (Cockerell)

Phileremus verbesinae Cockerell, Psyche (Suppl.), VIII, p. 10, 1895, ♀, nec ♂.

Neolarra verbesinae Baker, Proc. Ent. Soc. Wash., IV, p. 21, 1896. Cockerell, Bull. Sci. Lab. Denison Univ., XI, p 60, 1898, [key]. Cockerell, Bull. Univ. New Mex, I, p. 60, 1898, [key]. Swenk, Ent. News, XVIII, p. 297, 1907, [record]. Cockerell, Ann. Mag. Nat. Hist., (8), XVII, p. 285, 1916, [key].

Female. Head: First segment of flagellum longer than broad and longer than pedicel. Thorax: Axillae rounded; tegulae rufous; process of metanotum rather large, bilobed; two recurrent and two transverse cubital veins; tibiae, tarsi, and apices of femora rufous. Abdomen: Rather light red, apices of tergites one to five with distinct, white, pubescent fasciae; fifth tergite with deep apical notch. Length, 6 to 7 mm.

Type.—Female; Las Cruces, New Mexico; [T. D. A. Cockerell Collection].

Range.—Recorded from New Mexico and Nebraska. I have not seen specimens from the latter state.

Although supposed to have been described from males, specimens of this species in the collections of Dr. T. D. A. Cockerell and the United States National Museum bearing the original data and agreeing with the description are females. This error doubtless arose because of the notched sixth tergite of the female, which resembles somewhat the notched seventh tergite of males of certain other genera of parasitic bees.

Neolarra (Neolarra) congregata Crawford

Neolarra congregata Crawford, Jour. N. Y. Ent. Soc., XV, p. 181, 1907, (♀, ♂). Cockerell, Ann. Mag. Nat. Hist., (8), XVII, p. 285, 1916, [key].

This is a rather large species, though the smallest of the group in which the first flagellar segment is elongate. The abdomen is darker than in *verbesinae*, and the process of the metanotum is narrower than in *abdominalis*. The pubescence is white, that of the dorsum of head and thorax grayish.

Male. Head: Eyes separated by less than length of an eye; distance from median ocellus to posterior edge of vertex over half distance from median ocellus to bases of antennae; first segment of flagellum longer than broad and longer than pedicel; flagellum black above, brown beneath; bare space laterad to clypeus punctate; labrum black; mandibles dark testaceous, reddish apically. Thorax: Width across tubercles of pronotum only slightly less than width across mesepisterna; tegulae dark brown; axillae somewhat more narrowly arcuate than in figure 3; process of metanotum considerably narrower than half width of scutellum; legs very dark brown, bases and apices of tibiae sometimes reddish; two recurrent and two transverse cubital veins. Abdomen: Rather dark red, tergites two to five medially and tergites six and seven blackish; tergites one to six with apical white pubescent fasciae; process of seventh tergite rather broad, nearly parallel sided basally (similar to figure 10). Length 5 to 5½ mm.

Female Similar to male. Bases and apices of tibiae reddish. Length, 5 to 5.5 mm.

Type.—Female; Cotulla, Texas; [U. S. National Museum Collection].

This species appears to be known only from numerous specimens collected at the type locality.

Neolarra (Neolarra) abdominalis new species

Large species, having the form of the preceding. The abdomen is largely red, lighter than in *helianthi* or *congregata*. The broad process of the metanotum distinguishes the species from *congregata*, and the absence of a notch in the posterior margin of the fifth tergite of the female separates it from *verbesinae*. The pubescence is whitish, that of the dorsum of the head and thorax brownish.

Female. Head: Eyes separated by about the length of an eye; inner orbits about parallel below; distance from median ocellus to posterior edge of vertex greater than half distance from median ocellus to bases of antennae; first segment of flagellum longer than broad and longer than pedicel; flagellum dark brown above, pale brown beneath; labrum black; mandibles fuscous (testaceous in paratype), reddish apically. Thorax: Width across pronotal tubercles hardly less than width across mesepisterna; axillae slightly more narrowly arcuate than in figure 3; process of metanotum about half as broad as scutellum; two recurrent and two transverse cubital veins; legs very dark brown, nearly black, bases of tibiae testaceous. Abdomen: First four segments red, following segments nearly black; apical margins of tergites one to five with white, pubescent fasciae; margin of fifth tergite emarginate medially (Fig. 6). Length 6 mm.

Male. Similar to female; process of seventh tergite rather broad at base, tapering toward apex (a little more pointed than in figure 10). Length, 6 mm.

Holotype female, *allotype* male, and one female *paratype* from Montana (no further data). The types are in the collection of the Academy of Natural Sciences of Philadelphia.[4]

Neolarra (Neolarra) vandykei[5] new species

This is a rather slender, densely pruinose, species, quite variable in abdominal coloration. It is most closely related to *prinosa,* differing by the smaller tubercles, blacker legs, and the slightly more distinct abdominal fasciae. Pubescence white, somewhat brown on dorsum of head and thorax.

Female. Head: Eyes, where closest, separated by less than length of an eye; distance from median ocellus to posterior edge of vertex a little over half distance from median ocellus to bases of antennae; first segment of flagellum almost as long as broad and nearly as long as pedicel; flagellum testaceous beneath, dark brown above; anterior margin of clypeus testaceous; labrum testaceous; mandibles testaceous except for red apices. Thorax: Width of thorax across tubercles of pronotum less than width across mesepisterna; pronotal tubercles and tegulae black; axillae as in figure 3; process of metanotum bilobed; legs black, bases and apices of tibiae testaceous, tarsi dusky black; wings with two recurrent and two transverse cubital veins. Abdomen: Dark red, tergites four to six and sternites four to five dusky, nearly black; pubescence of abdomen distributed over surface, but distinctly more abundant at posterior margins of tergites one to five than elsewhere, forming weak fasciae; margin of fifth tergite with shallow emargination. Length, 5 mm.

Male. Similar to female but basal four segments of flagellum black; first segment of flagellum longer than broad and as long as pedicel; anterior tarsi testaceous; abdomen black; process of seventh tergite rather broad, short, pointed (Fig. 9), testaceous. Length, 5 mm.

Holotype female (Calif. Acad. Sci. Ent. No. 4571), *allotype* male (Calif. Acad. Sci. Ent. No. 4572), and three *paratypes*: Five miles east of Oakley, Contra Costa County, California;

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[4] I am indebted to Mr. E. T. Cresson, Jr., for the opportunity to study these specimens.

[5] This species is named in honor of Dr. E. C. Van Dyke, who, having collected several interesting bees at the type locality, directed me to it.

September 26, 1937, (C. D. Michener); two *paratypes* from same locality, September 19, 1937, (G. E. and R. M. Bohart).

Paratypes are in the collections of the American Entomological Society, the Boharts and the author.

In some females the abdomen is almost entirely black, while in others it is black except for the first two tergites.

Neolarra (Neolarra) pruinosa Ashmead

Neolarra pruinosa Ashmead, Colo. Biol. Assn Bull., I, p. 8, 1890, (♂ nec ♀). Fox, Ent. News, IV, p. 292, 1893, (♂). Baker, Proc. Ent. Soc. Wash., IV, p. 23, 1896, (♂ ♀). Cockerell, Bull. Sci. Lab. Denison Univ., XI, p. 60, 1898, [key]. Cockerell, Bull. Univ. New Mex, I, p. 60, 1898, [key]. Cockerell, Can. Ent., XXXI, p. 256, 1899, [record]. Cockerell and Atkins, Ann. Mag. Nat. Hist., (7), IX, p. 232, 1902. Cockerell, Ann. Mag. Nat. Hist., (8), XVII, p. 285, 1916, [key]. Cockerell, Univ Colo. Stud, XVI, p. 111, 1928, [record]. Cockerell, Am. Mus Nov., No 831, p 5, 1936.

Neolarra vittata Cockerell, Ann. Mag. Nat. Hist, (8), XVII, p. 285, 1916, (♂). [n syn]

This is a moderate sized, densely pubescent species in which the abdomen of the female is red, that of the male red or black. The large pronotal tubercles distinguish this species from its nearest relative, *vandykei.* The pubescence is white, slightly brownish on the dorsum of the head and thorax.

Female. Head: Eyes separated by slightly less than length of an eye; distance from median ocellus to posterior edge of vertex slightly more than half distance from median ocellus to antennal bases; first segment of flagellum broader than long and shorter than pedicel; antennae rufo-testaceous; anterior margin of clypeus testaceous; labrum testaceous; mandibles testaceous, red at apices Thorax: Pronotal tubercles and tegulae rufo-testaceous; pronotal tubercles large, width of thorax across them fully as great as width across mesepisterna; axillae slightly more narrowly arcuate than in figure 3; process of metanotum bilobed; wings with two recurrent veins and two transverse cubital veins; legs rufo-testaceous. Abdomen: Red, sixth segment darker; pubescence of abdomen rather sparse but distributed over entire surface, slightly more abundant on posterior margins of tergites than elsewhere, posterior margin of fifth tergite with a broad, shallowly V-shaped emargination. Length, 4 to 5 mm.

Male. Similar to the female; legs and abdomen in some individuals black; process of seventh tergite nearly as slender as in figure 8. Length, 3.5 to 4.5 mm.

Type.—Male; West Cliff, Colorado; [U. S. National Museum].

Range.—Rocky Mountain region, from Alberta to southern New Mexico.

ALBERTA: Medicine Hat, August 20, 1916, (F. W. L. Sladen), [Canadian Nat. Collection].

COLORADO: Fowler (E. S. G. Titus), [U.S.N.M.]. Fort Collins, (C. F. Baker). White Rocks, near Boulder (C. D. Michener).

NEW MEXICO: Mesilla Park; six miles north east of Embudo; August 25, 1931 (P. H. Timberlake, on *Cleome serrulata*).

Neolarra vittata Cockerell appears to be based upon a specimen of the black form of male *pruinosa*. Californian records of *pruinosa* refer, not to that species, but to *alba* and *californica*.

Neolarra (Neolarra) alba Cockerell

Neolarra alba Cockerell, Ann. Mag. Nat. Hist., (8), XVII, p. 285, 1916, (♂).

Neolarra pruinosa Cockerell (misidentification), Pan-Pac. Ent., v, p 104, 1929, [Riverside record].

This is a robust, densely white pubescent species in which the abdomen is red in the female and black in the male. The female differs from all of the smaller species except *californica* by the deep notch of the fifth tergite. The male differs from both *pruinosa* and *californica* by the broad process of the seventh tergite.

Male. Head: Eyes where closest together separated by about the length of one of them; distance from median ocellus to posterior margin of vertex about half distance from median ocellus to antennal bases; first segment of flagellum broader than long and shorter than pedicel; flagellum testaceous, darker above; labrum black; mandibles dark testaceous, reddish apically. Thorax: Width across pronotal tubercles slightly less than width across mesepisterna; tegulae brownish; process of metanotum rather small and short; axillae as in figure 3; bases of tibiae testaceous, apices of middle and hind tibiae more or less brownish; two recurrent and two transverse cubital veins present, second submarginal cell very short. Abdomen: Black, densely covered with white pubescence, only a little less dense on bases of tergites than on apices; process of seventh tergite testaceous, broad, tapering throughout, slightly blunt at apex (similar to figure 10). Length, 3.5 mm.

Female. Similar to male; eyes a little closer together; labrum more or less testaceous; tarsi and fore tibiae largely testaceous; abdomen red. so densely covered with white pubescence that it appears hardly pinkish in some individuals; fifth tergite with deep, median, posterior notch. Length 4 mm.

Type.—Male; Claremont, California; [T. D. A. Cockerell Collection].

Range.—Southern California west of the mountains.

CALIFORNIA: five miles west of San Bernardino, May 18, 1937, flying over sandy soil, (E. G. Linsley). Riverside, May 1 and 15, (P. H. Timberlake; on *Cryptantha intermedia*).

Neolarra (Neolarra) californica new species

Neolarra pruinosa Cockerell (not Ashmead), Pan-Pac. Ent., v, p. 104, 1929, [Whitewater record].

This is a small, rather robust, species, in which the abdomen is largely red in the female and black in the male. The pubescence is white, faintly brownish on dorsum of head and thorax. The female resembles *alba* in the deep notch of the fifth tergite, but *californica* averages distinctly smaller, and is somewhat less densely pubescent. The process of the seventh tergite of the male is distinctly narrower in *californica* than in *alba*. Furthermore, the outer hind tibial spurs of *californica* are usually about one half as long as the metatarsus, while in *alba* they approach two thirds the length of the metatarsus. Notwithstanding these differences, *californica* may prove to be a subspecies of *alba*.

Female. Head: Eyes separated by less than length of an eye; distance from median ocellus to posterior edge of vertex distinctly less than half distance from median ocellus to antennal bases; first segment of flagellum broader than long and distinctly shorter than pedicel; flagellum testaceous beneath, dusky testaceous above; anterior margin of clypeus narrowly dark testaceous; labrum dark testaceous; mandibles testaceous, apices reddish. Thorax: Width of thorax across pronotal tubercles not as great as width across mesepisterna; pronotal tubercles black; tegulae rufo-testaceous; axillae broadly arcuate (figure 3); process of metanotum slightly bilobed; wings with two recurrent and two transverse cubital veins, second submarginal cell very short; bases of tibiae testaceous; fore tarsi testaceous; metatarsi and apices of tibiae testaceous. Abdomen: Pinkish red, tergites four to six somewhat dusky; first tergite largely covered with white pubescence; pubescence distributed over tergites two to five, but denser on posterior margins of tergites than elsewhere, forming rather distinct white fasciae; fifth tergite with a deep median notch in posterior margin (figure 4) Length, 3 mm.

Male. Similar to female. Abdomen black, covered with white pubescence which is denser on posterior margins of tergites than elsewhere; process of seventh tergite rather slender (intermediate between those shown in figure 8 and 9).[6] Length, 4 mm.

Holotype female, (Calif. Acad. Sci. Ent. No. 4831); *allotype* male, (Calif. Acad. Sci. Ent. No. 4832); and five female and four male *paratypes*; from five miles west ("north" on label) of Indio, Riverside County, California (at junction of La Quinta and Palm Springs to Indio roads), April 10, 1936, (C. D. Michener; some on flowers of *Prosopis juliflora* var. *glandulosa,* most flying over the sand). Certain paratypes have been deposited in The American Entomological Society Collection.

Additional localities are:

CALIFORNIA: Dos Palmos, Riverside County, March 26, 1937, [Bohart collection]. Independence, Inyo County, June 14, 1937, (N. Frazier); Furnace Creek, Death Valley, April 8, 1939, (E. G. Linsley; flying about *Prosopis juliflora* var. *glandulosa*).

There is some variation among the paratypes, one female being 4 mm. long. A male (not paratype) has the abdomen slightly testaceous.[6]

Neolarra (Neolarra) linsleyi[7] new species

This is a largely black species, with white pubescence. It differs from *mallochi, cockerelli,* and *coloradensis* by the rounded axillae and the white pubescence which covers the entire dorsum of the abdomen, not being confined to the posterior margins of the tergites. This anomalous species falls between *Neolarra* s.str. and *Philercmulus,* and its characteristics support the treatment of *Phileremulus* as a subgenus of *Neolarra.* The scutellum is about as in typical *Neolarra*; the axillae are intermediate between those of *Neolarra* s.str. and *Philcremulus,* being rounded but rather narrowly so, and the notches on each side of them being deep; the wing venation is as in *Phileremulus.*

Male. Head: Eyes separated by distinctly less than length of an eye; distance from median ocellus to posterior edge of vertex less than half distance from median ocellus to bases of antennae; first segment of flagellum broader than long and shorter than pedicel; antennae testaceous, base of scape black, upper side of flagellum darker than lower; anterior margin of clypeus narrowly testaceous; labrum testaceous, suffused with blackish medially; mandibles testaceous, red at apices, Thorax: Width across prothoracic tubercles less than across mesepisterna; tegulae pale testaceous; axillae narrowly arcuate (figure 2); process of metanotum narrow, slightly bilobed; one recurrent and one transverse cubital vein, recurrent vein three-fourths of distance from base of apex of marginal cell; tibiae, tarsi, and apices of femora reddish testaceous. Abdomen: Black, posterior margins of tergites rather broadly reddish testaceous; abdomen with considerable white pubescence, which is denser along posterior margins of tergites one to six than elsewhere, forming weak fasciae; process of seventh tergite testaceous, moderately broad, and narrowly rounded at apex, tapering throughout (somewhat narrower than figure 9). Length, 5 mm.

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[6] This is the species whose genitalia and sternites were figured by Linsley and Michener, (Trans. Am. Ent. Soc., LXV, Pls. 16 and 17).

[7] This species is named for my friend, Dr. E. Gorton Linsley, with whom I collected at the type locality.

Female. Similar to male; antennae entirely testaceous; clypeus largely testaceous; legs and abdomen rufo-testaceous; posterior margin of fifth tergite nearly straight; posterior margin of sixth tergite with a deeper emargination than in other species (Fig. 7). Length, 4 mm.

Holotype male, (loan deposit to California Academy of Sciences), from five miles west ["north" on label] of Indio, Riverside County, California, (at junction of La Quinta and Palm Springs to Indio Roads); April 10, 1936; (C. D. Michener). *Allotype* female and one male *paratype* from Palm Canyon, Riverside County, California, [U.S.N.M.]. One male *paratype* from Coachella, Riverside County, California, April 23, 1927, (P. H. Timberlake; on flowers of *Prosopis juliflora*). One female *paratype* from Mecca, Riverside County, April 13, 1934, (P. H. Timberlake; on flowers of *Heliotropium curassavicum*).

In the Palm Canyon paratype the scape and pedicel are black, the upper side of flagellum is dark brown, and the abdomen is dusky testaceous. The Coachella paratype is less than 4 mm. long, while the Mecca paratype is over 5 mm. long. Four specimens from Dos Palmos, Riverside County, California, March 28, 1936 [Bohart collection] present still further variations. They differ from the above descriptions thus: Testaceous portions very pale yellowish; antennae pale testaceous; clypeus largely testaceous in both sexes; trochanters of males testaceous; femora pale, the dark areas of preceding description reduced and merely infuscated; abdomen in both sexes rufo-testaceous. These specimens are somewhat smaller than the types. Since there are many species of *Perdita* in the region, it seems possible that the differences may be due to differences in hosts. On the other hand, it is possible that we are dealing with more than one species of *Neolarra*.

Subgenus **PHILEREMULUS** Cockerell

Phileremulus Cockerell, Psyche, (suppl.), VII, p. 1895. Baker, Proc. Ent. Soc. Wash., IV, p. 20, 1896. Ashmead, Trans. Am. Ent. Soc., XXVI, p. 81, 1899. Cockerell and Robbins, Univ. Colo. Stud., VII, p. 183, 190, 1910. Crawford, Ins. Insc. Mens., IV, p. 136, 1916.

Axillae produced to distinct points; scutellum widest behind middle; one recurrent and one transverse cubital vein.

ORTHOTYPE: *Phileremulus vigilans* Cockerell.

Key to the species of the Subgenus Phileremulus

Males

1. Abdomen covered with white pubescence, denser on posterior margins of tergites; length just over 3 mm.......................... *vigilans*
   Tergites with white pubescence largely confined to their posterior margins; length about or over 4 mm 2
2. Process of seventh tergite broad, nearly parallel sided basally (figure 10)..*mallochi*
   Process of seventh tergite slender, tapering (figure 8)......*coloradensis*

Females

1. Recurrent vein joining submarginal cell three-fourths of distance from base to apex...*cockerelli*
   Recurrent vein joining submarginal cell two-thirds of distance from base to apex...2
2. Abdomen black; flagellum testaceous, darker above than beneath. *vigilans*
   Abdomen partly red; flagellum nearly black above, testaceous beneath. *coloradensis*

Neolarra (Phileremulus) cockerelli (Crawford)

Phileremulus cockerelli Crawford, Ins. Insc. Mens., IV, p. 139, 1916, (♀).

This is a small species with reddish abdomen and rather sparse pubescence.

Female. Head: Eyes where closest to each other separated by a little less than length of eye; distance from median ocellus to posterior edge of vertex over half distance from median ocellus to antennal bases; first segment of flagellum nearly as long as broad, shorter than pedicel; antennae testaceous beneath, brown above; labrum testaceous; clypeus dark brownish; mandibles testaceous, red at apices. Thorax: Width across pronotal tubercles less than width across mesepisterna; pronotal tubercles reddish; scutum nearly hairless; tegulae dark testaceous; process of metanotum small, bilobed; one recurrent and one transverse cubital vein present, recurrent vein joining submarginal cell nearly three-fourths of distance from base to apex of submarginal cell; legs reddish brown, tibiae, tarsi, and apices of femora rufo-testaceous. Abdomen: Dark red, with very weak fasciae on tergites one to five. Length, just over 3 mm.

Type.—Female; Victoria, Texas; [U. S. National Museum Collection].

TEXAS: Fedor, October 11, 1899, [U.S.N.M.].

A pair of specimens from Cedar Glade Area, Middle Tennessee, swept July 5, (529), (Adelphia Meyer), [U.S.N.M.] are apparently *cockerelli* but the legs and antennae are slightly darker and the apex of the abdomen is dusky.

Neolarra (Philercmulus) vigilans (Cockerell)

Phileremulus vigilans Cockerell, Psyche, (suppl.), VII, p. 9, 1895, (♂ ♀). Baker, Proc. Ent. Soc. Wash., IV, p. 22, 1896. Cockerell, Bull. Sci. Lab. Denison Univ., XI, p. 60, 1898, [key]. Cockerell, Bull. Univ. New Mex., I, p. 60, 1898, [key].

Phileremulus nanus Cockerell, Psyche, (suppl), VII, p. 9, 1895, (♀). Cockerell, Bull. Sci. Lab. Denison Univ., XI, p. 60, 1898, [key]. Cockerell, Bull. Univ. New Mex., I, p. 60, 1898, [key]. Cockerell, Ann. Mag. Nat. Hist., (7), V, p. 416, 1900, [record]. Cockerell and Atkins, Ann. Mag. Nat. Hist, (7), IX, p. 232, 1902.

This is a small species, with the abdomen of the female largely reddish, that of the male black. The pubescence is white.

Male. Head: Eyes where closest together separated by fully the length of one of them; distance from median ocellus to posterior edge of vertex less than half distance from median ocellus to antennae; first flagellar segment broader than long and shorter than pedicel; apical margin of clypeus testaceous; labrum testaceous; mandibles testaceous except for ferruginous apices. Thorax: Width across pronotal tubercles less than width across mesepisterna; tegulae testaceous; recurrent vein joining submarginal cell about two-thirds of distance from base to apex of cell; tibiae, tarsi, and apices of femora testaceous; process of metanotum small. Abdomen: Black, posterior margins of tergites testaceous; abdomen with white pubescence which is denser on posterior margins of tergites than elsewhere; process of seventh tergite slender (similar to figure 8), rufous. Length, 3.5 mm.

Female. Abdomen rufous, segments five and six blackish. Length, 3 to 3.5 mm.

Type.—Male; Las Cruces; New Mexico.

Range.—Deserts of New Mexico and southern California.

NEW MEXICO: Santa Fe and Las Vegas.

CALIFORNIA: Hodge, San Bernardino County, (Mojave Desert), September 14, 1935, (C. D. Michener; on *Cleomella obtusifolia* and sand beside it).

Neolarra nanus seems to be the same as *vigilans*, the apparent differences resulting from the wear of pubescence on the face and from the collapse of the apical segments of the antennae in *nanus*.

Neolarra (Phileremulus) mallochi (Crawford)

Phileremulus mallochi Crawford, Can. Ent., XLIV, p. 359, 1912, (♂).

This is a moderate sized species, with largely red abdomen, and distinct white fasciae on the posterior margins of the abdominal tergites. The pubescence of the face, cheeks, and sides of thorax is white, that of vertex and dorsum of thorax brownish. This species is related to *coloradensis*, which differs by the narrow process of the seventh tergite of the male.

Male. Head: Eyes separated by slightly more than greatest length of one of them; distance from median ocellus to posterior edge of vertex considerably more than half distance from median ocellus to bases of antennae; first segment of flagellum about as long as broad and slightly shorter than pedicel; flagellum testaceous, darker above than beneath; bare spots on sides of clypeus polished and impunctate; apex of clypeus testaceous; labrum testaceous; mandibles testaceous, rufous apically. Thorax: Width across prothoracic tubercles less than width across mesepisterna; tegulae dark brown; process of metanotum bilobed, narrower than half width of scutellum; one recurrent and one transverse cubital vein; recurrent vein joining submarginal cell about two-thirds of its length from base to apex; tibiae, tarsi, and apices of femora testaceous. Abdomen: Red, tergites five to seven dusky medially; apical margins of tergites one to six with distinct, white, pubescent fasciae; process of seventh tergite broad, rather parallel sided basally, narrowly rounded apically (Fig. 10). Length, 4 mm.

Type.—Male; Medicine Hat, Alberta; [U. S. National Museum Collection].

Additional specimens from the same locality, August 20, 1916 (F. W. L. Sladen) are in the Canadian National Collection.

Neolarra (Phileremulus) coloradensis new species

This is a moderate sized species, with the abdomen partly red in both sexes. The pubescence is white, except that of the dorsum of the head and thorax, which is brownish. This species differs from its nearest relative, *mallochi*, by the more slender and more sharply pointed process of the seventh tergite of the male.

Male. Head: Eyes separated by slightly less than length of an eye; distance from median ocellus to posterior edge of vertex more than half distance from median ocellus to bases of antennae; upper side of flagellum dark brown, under side testaceous; first segment of flagellum about as long as broad, shorter than pedicel; bare spaces at sides of clypeus roughened; anterior margin of clypeus narrowly testaceous; labrum testaceous; mandibles testaceous except for rufous apices. Thorax: Width across pronotal tubercles less than width across mesepisterna; tegulae reddish, inner margins black; process of metanotum of moderate size, bilobed, much narrower than half width of scutellum; one recurrent vein and one transverse cubital vein; recurrent vein joining submarginal cell less than two-thirds of distance from base to apex of the cell; tibiae and apices of femora testaceous, hind tibiae blackish medially; fore tarsi testaceous; middle and hind tarsi, except for the testaceous middle metatarsi, black. Abdomen: First two tergites red, third red medially, fourth red on posterior margin; apices of tergites one to six with distinct apical pubescent fasciae; process of seventh tergite rather slender, tapering throughout, pointed at apex (Fig. 8), rufous; sternites reddish posteriorly and laterally. Length, 4½ mm.

Female. Similar to male but with face somewhat narrower; clypeus and labrum black; bases of mandibles black; first three tergites and apical margins of fourth and fifth tergites red; posterior margin of fifth tergite nearly straight. Length, 4 mm.

Holotype male, (Calif. Acad. Sci. Ent. No. 4573); *allotype* female, and eight male *paratypes*: Roggen, Colorado, August 26, 1935, (C. D. Michener on sand and on flowers of *Eriogonum*).

Allotype and certain paratypes in the author's collection, additional paratypes in the collection of the American Entomological Society.

Among the paratypes there is considerable variation in the amount of red on the abdomen. In one individual the red is confined to the first tergite, and in another the abdomen is nearly all black. Furthermore the hind and middle legs may be entirely black.

STUDIES ON NEOTROPICAL GOMPHINE DRAGONFLIES

(ODONATA)

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(Plates XX to XXII)

It has long been apparent that some of the problems in systematic arragement of adult dragonflies might be helped toward a solution if more were known about their immature stages. This statement especially applies to Gomphine dragonflies, in the classification of which no one's proposals have as yet been very convincing. In the following pages I desire to offer some data derived from the study of new nymphal material from Neotropical sources. Much more is still needed. I offer only factual data: not final conclusions.

I first present some facts confirming two of the Selysian genera, *Aphylla* and *Cyclophylla,* that have latterly been treated as synonyms of *Gomphoides.* The evidence of their validity and distinctness in the nymphs is very striking, and I have found adult venational differences that correspond and corroborate.

Then I wish to add some notes concerning *Aphylla caraïba* Selys, descriptions of three new types of Gomphine nymphs, a key to Neotropical adult Gomphine genera, and a description of a new species of the peculiar and isolated genus *Cacus.*

I. ON THE GENUS GOMPHOIDES OF DE SELYS

In 1854 de Selys established the genus *Gomphoides* for ten species of large Neotropical dragonflies. At the same time he divided it into three subgenera, *Gomphoides* s. str., *Aphylla* and *Cyclophylla,* basing these on the differences shown in the following table:

	Gomphoides	*Aphylla*	*Cyclophylla*
No. of cells in fore wing triangle	4	2–3	2–3
No. of cells, fore wing subtriangle	3–4	2–3	2–3
No. of cells, hind wing subtriangle	3–4	1	1
Abdominal segments 8 and 9 in male	dilated	not dilated	dilated at sides and leaflike
Apical inferior angle of 10 in ♂	rounded	produced backward in a point	not produced

It is to be remembered that de Selys had but one sex for three out of ten of his species, and that therefore he had to rely on such venational characters as are not sex limited and he trusted too much to the presence or absence of weak crossveins, especially to those in the subtriangle of the hind wing.

Nineteen additional species came to hand and were described by him in four successive additions to his synopsis of the Gomphines. As often happens, some of them failed to conform to his first definitions of subgenera. One that he called *Cyclophylla protracta* had in the male something of the lateral expansion of the eighth and ninth abdominal segments of that genus, coupled with marked prolongation of the postero-lateral angles of the tenth segment that characterizes *Aphylla,* and that suggested the specific name. He trusted the wrong character—a mistake in placement that has persisted down to the present day.

With new material came more trouble. Among the seven new species added in 1869 was his *Gomphoides annectens,* which had a single celled subtriangle in both hind wings. After describing it he expressed doubt as to whether his three subgenera should not be united into one.

In 1873 he described as *Gomphoides ambigua* a species that is now clearly seen to belong in *Aphylla*; however he had at that time only the female and he stated that knowledge of the male was needed to determine its allocation.

These aberrant species so far transgressed the boundaries of his three subgenera (which the cataloguers have treated as genera) as to raise grave doubts of their validity, and all later describers[1] of new species except Kirby (1899) have used the prior name, *Gomphoides*, for all of them, whatever their characteristics.

Clearly, the groups are ill-defined as de Selys left them. Dr. Ris suggested that better characters might possibly be found in a study of the anal field of the hind wing. I have found that the three genera may be recognized in all the adult material that has come before me by the following combination of venational characters:

	Aphylla	*Cyclophylla*	*Gomphoides*
Anal loop	ill-defined or wanting	of 1 or 2 cells sharply defined by convergence of A_1 and A_2 at its rear	of 3 to 5 cells sharply defined by convergence of A_1 and A_2 at its rear
Distal portion of vein A_2	generally parallels vein A_1	is strongly convergent with A_3	is variable
♂ inferior abdominal appendage ..	apparently wanting	apparently wanting	well developed and deeply forked

Also the hind wing is widened toward the base at the rear in *Gomphoides* more than in the other two genera, and the anal loop is broader and more divided up into cells: as a rule its subtriangle is divided in *Gomphoides* and free from crossveins in the other two, as de Selys first found it; where not so, the deviation is generally restricted to one side of the specimen. I have not seen the species that gave de Selys the most trouble, his *Gomphoides aberrans*.

NYMPHAL GROUP CHARACTERS

That excellent characters are available for separating the nymphs into three groups will be seen by comparing the three figures at the top of Plate XX. No one appears to have made any use of them hitherto although they have long been known. Nymphs of two species were figured by Cabot in 1872 (his numbers 1 and 10), and another (No. 11, very similar to No. 10) was briefly described in the text. No. 1 was referred by supposition to *Herpetogomphus,* Nos. 10 and 11 to *Gomphoides* in the inclusive sense in which Hagen had used that name in his Synopsis in 1861.

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[1] These are Calvert 1905, 1907 and 1909, Ris 1912, Campion 1920, Navas 1924, 1933, and Gloyd 1937. It should be noted, however, that Calvert (1905) arranged the Central American species of his inclusive genus *Gomphoides* in three groups that correspond to the three subgenera when correctly interpreted, and that subsequently (1909) he indicated clearly the subgenus to which each of his new species belonged.

In 1885 Hagen redescribed all these and added a fourth. In the meantime he had obtained a reared specimen of *Herpetogomphus,* which showed him that Cabot's No. 1 (his own No. 29) could not belong to that genus, so he made another equally bad guess and called it *Epigomphus paludosus* supposition. It is in fact a true *Gomphoides.* Of Cabot's No. 10 (his own No. 33) he said "I think it may belong to *Cyclophylla*". This was correct, and applied also to Cabot's No. 11 (his own No. 34).

He described also as No. 35 another species from Crescent City, Florida, that he placed correctly (as to the genus only) when he called it "*Aphylla producta* supposition".

In 1904 I published figures and descriptions of the nymph of *Gomphoides stigmatus* from Texas, a nymph with unmistakably close affinity to Cabot's No. 1. After studying the nymphal types of Cabot and Hagen at the Museum of Comparative Zoology, I published in 1911, a little paper supplemental to that of Dr. Hagen, in which I presented new figures of the labia of all these forms, and pointed out that the venation of the developing wings of these nymphs indicates in sufficient detail that Cabot's No. 1 is a *Gomphoides* s. str., and that Hagen's (1885) subgeneric suppositions were verified as to *Cyclophylla* and *Aphylla.*

Meanwhile the distinctness of these three types of nymphs has been further evidenced by the rearing of two more individuals representing other species of *Aphylla* and *Cyclophylla,* and by the discovery of nymphs of others.

Dr. C. F. Byers worked out the life history of *Aphylla williamsoni* in Florida and published an account of it in 1930 (as *Gomphoides ambigua*). Dr. F. X. Williams reared *Cyclophylla volsella* at El Salto, Escuintla, Guatemala, in 1934 and sent me the specimens. They are hereinafter described and figured.

In the spring of 1936 I went down below the Nueces River in Texas and there collected the nymph of *Aphylla protracta,* and in the spring of 1937 I went to Soledad, Cuba and there collected nymphs and exuviae of a species of *Aphylla* identical in venation with the one known local species, which seems to me to be *Aphylla caraïba* Selys.[2]

In addition to this material I have received nymphs from a number of other sources as will be detailed in the descriptive matter that follows, and they conform closely to three types, and abundantly justify three genera, as genera now go.

The known nymphs of the *Gomphoides Complex* agree in having the tarsi 2–2–3–jointed, the fourth antennal segment a minute cylindric rudiment, the flat labium with a strong end hook and the mentum with a prominent median lobe. The abdomen is long and tapering, with a tenth segment of very variable length according to the genus, and with caudal appendages of equal length each to each or the laterals a little shorter than the others. Grown nymphs are concolorous, having taken on the color of the silt in which they burrow, though some Cyclophyllas are striped with a pair of dorsal submedian lines of black on the abdomen when younger.

GOMPHOIDES s. str.

The distinguishing features of nymphs of this genus are the *Gomphus*-like appearance of body and labium and the relatively short tenth abdominal segment. The median lobe of the mentum is moderately produced in a low rounded curved spinulose border, and the teeth on the inner margin of the lateral lobe are minute, low and rounded and diminish gradually in size toward both ends of the row, more gradually proximally. Segment 10 of the abdomen is but little longer than 9.

The nymph resembles that of *Dromogomphus,* but that has longer legs, a parallel-sided mentum with straight front border, and the spines of the ninth abdominal segment are longer and more closely appressed than those of the preceding segments.

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[2] A parallel elongation of the tenth abdominal segment is found in an unknown Gomphine nymph from Bismarchburg, Togoland, West Africa. It was described and figured by Karsch in 1893 Berlin. Entom. Zeit., XXXVIII, p. 47, figs. on four plates. I later published The Life of Inland Waters, p. 209, 1916, a photograph that I made from Karsch's specimen.

Two species have been described and figured. Only one (*G. stigmatus*) has been reared. Two additional are described below.

Gomphoides infumatus Selys (supposition)

This nymph was well illustrated by Cabot (1872, pl. I, figs. 2, 2b & 2c) and referred (by Hagen) to the genus *Herpetogomphus* by supposition. It was redescribed by Hagen (1885, p. 272) with some additional detail, and referred to *Epigomphus paludosus*. In 1911 (Pl. XIV, fig. 1) I published a new figure of its labium. Having previously obtained reared nymphs of *Gomphoides* from Texas I was able to refer this one to that genus with assurance. It differs from the other species now known by having a pair of minute submedian denticles on the free border of the median lobe of the labium. The specific reference may prove to be another bad guess but the generic name at least will stand.

The labium of another species of this genus, represented in the Museum of Comparative Zoology by a mere fragment of a specimen, I also figured at the same time (1911, Pl. XIV, fig. 2). It bore M. C. Z. No. 436.

Gomphoides stigmatus Selys (Figs. 2, 5, 39, 49, 50.)

In 1904 I published a description and figures of the nymph of this species (p. 687, pl. XXXVIII, fig. 1; photograph of whole nymph and pl. XLIII, fig. 1; its labium). This was determined by venation of the nymphal wings, later confirmed by obtaining specimens that were taken in transformation.

I have two nymphs collected by myself in the Arroyo de la Presa, near Victoria, Tamaulipas, Mexico, on March 1st 1936 that I cannot now distinguish from those from Texas. One is in the penultimate instar and the other less than one third grown. Both show a faint middorsal band of blackish color on the abdomen with pale dorsal hooks arising out of it. I have collected a similarly marked young one at Reagan Wells, Texas.

In the Williamson collection of the Zoological Museum of the University of Michigan there are similar Mexican specimens: one from the Rio Potosi, fifteen miles north of Linares, Nueva Leon; one from twenty-three miles south of Alamo, Vera Cruz, and three from fourteen miles south of Alamo, Vera Cruz, all collected by E. P. Creaser, in various nymphal stages.

Gomphoides bifasciatus Selys (supposition) (Figs. 10, 20.)

In the Cornell University collection are two nymphs, one grown and the other about two instars younger, that were collected by Dr. J. C. Bradley at Barro Colorado Island in the Panama Canal Zone. They are here doubtfully referred to the only known regional species of the genus.

The larger nymph measures in length 30 mm., abdomen 20, hind femur 4.5; width of head 4.5, of abdomen 6. This is a rather slender species, quite without color pattern, its generally pale color darkening on the end of the abdomen. It is thinly hairy. The very slender fourth antennal segment is a little longer than the third is wide at apex. The labium has a short sharply inturned end hook with half a dozen low denticles before it, that are broader than those of *G. stigmatus*.

The dorsal hook on the second abdominal segment is merely a low mound. The hooks on 3 to 9 are laterally flattened, pointed backward, increasing in size to rearward, as do the lateral spines on 7, 8 and 9. All these are longer than in other species now known, and the lateral spines of 7 are distinctly divergent. Abdominal segment 10 is one third longer than 9, and the caudal appendages are longer than 10 is wide at its apex. The laterals are a trifle shorter than the others.

Gomphoides sp. No. 4 (Figs. 14, 23.)

Another species is represented by four specimens in the Williamson collection, three nymphs and a broken fragmentary cast skin. It is a smaller species than the preceding with similar form of labium but with fewer and broader denticles on the inner border of the lateral lobe of the labium (Fig. 14) and with a shorter tenth abdominal segment (hardly one fourth longer than 9).

Length 26 mm., abdomen 20, hind femur 4; width of head 6, of abdomen 7. Dorsal hooks on 2 to 9, on 2 rudimentary, on 3 to 5 larger thick blunt-tipped, on 6 to 9 longer thinner and sharper, that of 9 reaching beyond the middle of 10.

One nymph from Xenaba II Cenote, Chichen Itza, Yucatan, 27 VI, '32 and one from Chiuoh Cenote, Mukuyche Yucatan, and one from Rio Guayalago at Simon, twelve miles south of Xicotencatl, Tamaulipas, Mexico; all collected by E. P. Creaser.

Also one fragmentary exuvia from the first named locality collected by A. S. Pearse.

Gomphoides sp. No. 5

Length 33 to 34 mm., abdomen 21, hind femur 5; width of head 6, of abdomen 8.

This is a rather hairy nymph, with conspicuous bare scarlines on the legs and bare spots on the body: those on rear of head, round; those on the disc of the prothorax, larger and irregularly ovoid. The fore and middle tibiae are armed with heavy burrowing? hooks. The antennae are four jointed with the subcylindric third joint more than twice as long as the two basal joints together and widest beyond the middle, and with the sides heavily fringed with long hairs; the fourth a minute cylindric rudiment. The labium widens from the hinge outward regularly from the base of the mentum, which is a third longer than wide. Its median lobe is somewhat convex and its edge is fringed with a very dense row of flattened scale-like hairs. The end hook of the lateral lobe terminates in a rather blunt point before which on the inner side are about ten very minute denticles, so small as to be barely visible with a low power lens.

The abdomen is regularly lanceolate, its lateral margins are fringed with long yellowish hairs. Dorsal hooks in a regular series, slightly increasing in size from front to rear on segments 3 to 9, obsolete on 2. There are strong subequal lateral spines on segments 7, 8 and 9, that of 9 being about a third as long as segment 10. The caudal appendages are slightly shorter than 10, all are equal in length, sharp pointed and nearly bare.

Six exuviae from Nova Teutonia, Brazil, 6–XI–'35 collected by Fritz Plaumann, sent by Dr. P. P. Calvert.[3]

APHYLLA

The nymphs of this genus are easily distinguished by the form of the labium, which is armed on the inner margin of each lateral lobe with large sharp-pointed recurved teeth: also, by its entire lack of lateral spines on the abdominal segments, and by the extreme length of the tenth segment, which comprises about a third of the length of the entire abdomen. The dorsal hooks of abdominal segments 2 to 9 are broad, mostly low humps, that diminish in size to rearward, sometimes becoming obsolete there.

The most marked difference between species is found in the number of teeth before the end hook of the lateral lobe of the labium, there being:

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[3] Dr. Calvert writes me that he will present his material to the Academy of Natural Sciences of Philadelphia.

Two (exceptionally one or three on one side only) in *A. caraiba*;
Three in the nymph No. 3 from Chucara, Mexico;
Four in *A. williamsoni* (exceptionally five), in *A. protracta* (exceptionally three) and a species from Yuncu, Mexico;
Seven in a species from Ceara, Brazil.

These exceptions suggest caution in the use of these numbers as criteria for distinguishing species.

Aphylla williamsoni Gloyd (Fig. 15.)

Although the adult of this species has been so recently (1936) described and named, its nymph has long been known.[4]

The largest nymph from Newman's Lake, near Gainesville, Florida, measures in total length 68 mm., abdomen 50, tenth segments 22.5, hind femur 6; width of head 11, of abdomen 12. There is a range in length of the variable tenth segment in the specimens before me from 19 to 23 mm.

This is a silted nymph, entirely without color pattern. It is almost hairless except for tufts about the face and thin fringes on the tibiae, especially on the fore tibiae. The fourth antennal segment is a very minute oval rudiment much shorter than the apex of the third is wide. The teeth before the end hook on the lateral labial lobe are four, preceded by a rather long basal plate on the inner margin, out of which on one side in one specimen a fifth tooth is formed The broadly rounded median lobe is very slightly truncated, in its middle third.

The dorsal hooks on abdominal segments 2 to 9 are hardly more than low broad tubercles, more conic on 2, highest on 3 and obtusely pointed on its posteriorly curved tip, diminishing in size on succeeding segments and more or less obsolete on 8 and 9. There are no lateral spines, but there is a rather sharp postero-lateral angle on segment 9. The subequal caudal appendages are hardly as long as segment 10 is wide at the tip.

My material has come from various sources: Three exuviae from Newman's Lake near Gainesville, Florida, presented me by Dr. C. F. Byers: Two exuviae presented me by Dr. E. S. Hathaway in Louisiana, one from Bayou des Allemands, some miles north of New Orleans, and the other from a pond in Audubon Park in that city, collected by George H. Beck on July 9, 1937.

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[4] Hagen, H. A., 1885, p. 277, two exuviae from Crescent City, Florida: (as *Aphylla producta* supposition); a good description.

Needham, J. G. (1916 (first edition) and 1928 (fourth edition) "Guide to the Study of Fresh-water Biology" (as *Aphylla*) plate 4, figures 2 and 2a (whole nymph and detached labium of a half-grown specimen). Also, "Handbook of the dragonflies of North America," page 60, figs 2 and 2a (same as preceding, repeated).

Byers, C. F. 1930, pp. 45-48 and 244-247 (as *Gomphoides ambigua*) Description and account of habits Also, 1934, p. 214, Florida records.

Gloyd, L. K. 1936 (as *Gomphoides williamsoni* n.sp.). Further Florida records).

One half-grown nymph was collected for me by Dr. Adolph Hempel at Gotha, Florida, in 1897. Another that I collected myself with the help of Dr. George H. Bradley, March 9, 1939; a partly grown specimen, like the one figured in my papers mentioned above, from Lake Olivia on the outskirts of Gotha, Florida. I collected in many lakes in Florida, and this is the only *Aphylla* nymph that I found. It was obtained by sifting bottom mud from water about knee-deep.

I have assumed in the above bibliography that the two exuviae described by Hagen are of this species, although a trifle smaller (length 58 mm.; the smallest of mine, 60 mm.).

Aphylla protracta Selys (supposition) (Figs. 12, 22.)

This nymph was first made known by Dr. P. P. Calvert in "Notes on a Gomphine Exuvia from Williams Lake, Matagorda Co., Texas".[5] He recognized it as distinct from the nymphs of the preceding species (then known as *A. producta*), but did not name it. His notes are brief and mainly comparative. At that time no one suspected that *protracta* was not a true *Cyclophylla*.

The close agreement in venation between the nymphs I obtained in Texas in 1934 with adults obtained there leaves little room for doubt as to their specific identity. The following description is based on a well grown nymph from Edinburg, Texas. I have had for comparison the above mentioned exuvia, kindly loaned me from the Williamson Collection at the University of Michigan.

This nymph (apparently in the penultimate instar, the wing venation being fully developed within the thin sheaths) measures in length 46 mm. abdomen 33, tenth segment 11, hind femur 4.5; width of head 7, of abdomen 8.

Very similar to the preceding species, though smaller in stature, a little more hairy in front and with the tenth abdominal segment somewhat shorter. The median lobe of the labium (Fig. 22) is regularly curved in front—not at all straight-edged in its middle portion. The proximal tooth on the inner border of the lateral lobe of the labium is nearer the base, with less of a chitinized untoothed border intervening. The dorsal hooks

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[5] Entom. News, xxv, pp. 454-5, 1914.

are larger, being about as shown for *Aphylla* No. 4 in figure 17, the first (on segment 2) being as high as the second with a peculiar little blunt hooked tip. The caudal appendages are slightly longer than segment ten is wide at its apex.

One nymph collected by Prof. Stanley Mulaik, near Edinburg, Texas, and one half grown specimen collected by myself under the guidance of Professor Clyde Reed from a creek on the King ranch near Kingsville, Texas are in the Cornell University Collection.

Aphylla caraiba Selys (Figs. 3, 41, 43, 43a.)

I went to Cuba in 1927 to get nymphs of this species and first found them at Soledad, near Cienfuegos. I was aided by the open hospitality of the Atkins Institution of Harvard University at that place, and by the friendly guidance of Mr. Walsingham, assistant superintendent of the Garden, who helped me in locating collecting places. In an artificial pond, the northernmost one in the Garden, near the cactus garden, on first approach I saw two skins lying flat on the bare mud of the shore within a few inches of the water's edge. The pond was nearly destitute of water weeds, but abounded in plancton algae, as was evidenced by the greenish brown color of the water. The bottom was composed of inwashed gray silt, overlying a sticky black soil. The nymphs were burrowers in the silt. They were not abundant, but by sifting the silt for several hours I was able to find more than a dozen of them. Associated with them were many tube-dwelling Chironomid larvae, and hardly any other animals whatever. The pond was of relatively recent construction. Later I found in one of the old ponds in the Garden (the one at the fork downstream) in a dense bed of water weed, an empty exuvia lying across the floating leaves of a *Potamogeton* tangle, through which the nymph had been able to climb for its transformation.

Returning to Soledad in 1939, I had the pleasure of a collecting trip with the guidance and help of Mr. David Sturrock, Superintendant of the Garden, eastward into the Trinidad Mountains, and there in Rio de San Antonio, by Charco Azul I found the nymph again, this time in a bare muddy bank of a river bed. Later while collecting in the province of Piñar del Rio, I found nymphs at San Diego de los Baños among water weeds in an embankment of a stream, and also fresh exuviae lying atop of the floating leaves on the surface. On showing these cast skins to Prof. Leon Boucle of the Cuban Experiment Station he said he had seen the like in great numbers on the sloping side of a stock-watering basin.

Apparently these nymphs are adaptable to a great variety of situation in Cuba: perhaps also in Hayti, for I found the nymph at Damien and Frazar got adults (now in The Museum of Comparative Zoölogy) at Samana, Dominican Republic.

The nymph may be described as follows:

Length 42 mm., abdomen 31, tenth segment 10.5, hind femur ♀ 6; width of head 6.5.

The minute cylindric rudimentary fourth antennal segment is hardly as long as segment three is wide. The mentum of the labium is almost parallel-sided, its median lobe is low and rather sparsely beset with short sharp spinules. Before the strong end hook of the lateral lobe there are usually two teeth (occasionally on one side one, or three of which the proximal is slightly larger and much more strongly recurved.

The dorsal hooks on abdominal segments 2 to 9 are low, blunt, half erect on 2 and 3, slightly higher on 3, becoming lower and broader and blunter to rearward and in one specimen obsolete on 9. The caudal abdominal appendages are hardly as long as 10 is wide at the tip.

Of this species I obtained two exuviae and one penultimate instar nymph at Damien, Haiti, on April 3, 1930, three exuviae and many penultimate instar nymphs at Soledad, Cuba on April 27, 1937, and the additional nymphs and exuviae mentioned above in the Trinidad Mountains of Santa Clara province and in the Pinar del Rio province in 1939.

Aphylla sp. No. 3 (Fig. 26.)

Length 41 mm., abdomen 27, tenth segment 10, hind femur ♀ 5; width of head 6, of abdomen 7.

This is a small, rather hairy, heavily silted nymph apparently in its last instar. The fourth antennal segment is rudimentary, a minute spherical terminal knob on the apex of the third. The mentum of the labium is distinctly widened forward, its median lobe is narrower than in the two following species, less than one third of the entire apical width of the mentum, and densely fringed with stout brown spinules. The end hook of the lateral lobe is rather straight beyond its base, and before it are three sharp teeth of which the distal one is smallest.

The dorsal hooks on abdominal segments 2 to 9 are all laterally flattened, low and blunt-tipped, the second and third are higher than the others. The caudal appendages are rather shorter than the tenth segment is wide at its apex.

One full grown (?) nymph from Estero Chucharas "25 mi. from mouth Osteos. Mexico Creaser [E. P.] and Gordon [Myron] IV 30-31 '30" in the Zoölogical Museum of the University of Michigan.

Aphylla sp. No. 4 (Figs. 13, 17, 18.)

Length (exuvia) 50 mm, abdomen 35, tenth segment 12; width of head 6.5, of abdomen 7.5.

This is a moderately hairy, heavily silted nymph with the hairiness more restricted to the areas about the leg bases. The fourth antennal segment is equally minute as in the preceding species; the mentum of the labium is a little widened distally, its median lobe is slightly wider, equalling one third the width of the whole; the end hook is a trifle more curved, and before it on the inner margin are four subequal and very sharp teeth that diminish slightly in size to rearward, on one side and five on the other (fig. 18). There are dorsal hooks on the second to the eighth abdominal segments, erect and conical on 2, higher and broader on 3, lower and progressively more rudimentary on 4 to 8. Caudal appendages somewhat shorter than 10 is wide at tip.

One exuvia from Mexico bearing the label "Tamos VIII–28–33 C. W. S." in the Zoological Museum of the Univ. of Mich.

Aphylla sp. No. 5 (Fig. 16.)

Length, 50 mm., abdomen 35, tenth segment 14; width of head 6, of abdomen 7.

This is a slenderer cleaner more sparsely hairy nymph, with better development of dorsal abdominal hooks. The fourth antennal segment is longer being a short cylindric rudiment The mentum of the labium is a little widened forward, and its median lobe covers a little more than one third of the median breadth and the short pale spinules that fringe its margin are more sparce than in the two preceding species. Before the rather straight end hook of the lateral lobe are four sharp subequal teeth. The dorsal hooks on abdominal segments 2 to 9 are subequal on 2 and 3, wider and progressively lower on 4 to 9 becoming rudimentary on 9. The caudal appendages are as long as 10 is wide at its apex.

One exuvia from Yuncu Aguada, Yuncu, Yucatan, Mexico, collected by E. P. Creaser July 29, 1932 and now in the Zoological Museum of the University of Michigan.

Aphylla sp. No. 6 (Fig. 11.)

Length, 41 mm., abdomen 30, tenth segment 10, hind femur 5; width of head 6.5, of abdomen 7.

This is a soft-hairy, heavily silted species, with very low and broad rudiments of dorsal hooks. The fourth antennal segment is a minute subcircular rudiment. The mentum of the labium is distinctly widened distally and its low median lobe is deeply recessed in the front border, and sparsely fringed on its slightly convex margin with short irregular spinules. Its end hook has an almost sigmoid curvature and before it are seven long sharp close-set teeth that diminish in size proximally. In one specimen the two proximal teeth on the lateral lobe are very small and in a half grown specimen they number but six on one side and five on the other.

The dorsal hooks of abdominal segments 2 to 8 are low and broad. They have a semblance of hooked tip on 3, are highest on 4 and they diminish in size to rearward disappearing on 9.

Two exuviae from Açude São Bento, No. 11.374 and one half grown nymph from Açude de Soure No. 11.417, both in Ceara, Brazil and sent me by Dr. R. von Jhering.

CYCLOPHYLLA

This genus is easily recognized by the form of the labium. Its median lobe is produced in a semicircular plate that is densely bordered with long flat scales, and the inner margin of its slender lateral lobe is entirely smooth. It approaches *Aphylla* in having the tenth abdominal segment one third the length of the abdomen (as long as 7+8+9) and the shortness of dorsal hooks, but differs in having short sharp lateral spines on segments 6 or 7 to 9.

One species, *C. volsella*, has been reared, two others were described by Cabot in 1872, and positively identified by me as to the genus in 1911, and three more are described herewith.

Cyclophylla volsella Calvert (reared) (Figs. 1, 4, 7, 19, 40, 44.)

Length of body 29 mm., abdomen 23, tenth segment 6.5, hind femur 5; width of head 5, of abdomen 5.5.

This is a rather slender nymph with long smoothly tapering abdomen. The fourth antennal segment is cylindric and pointed, distinctly longer than the third is wide at its widest place. The mentum of the labium is much widened to its outer angles; the lateral lobe is strongly tapered to the base of its hooks and the slender end hook is hardly half as large as the movable hook and toothless on its inner border. The sigmoidly curved fore tibia have a small external burrowing hook followed by a dense fringe of long brown hairs extending almost to the base; the upper side is flattened, with a long fringe of erect hairs on either margin. The femora are bare externally but have a copious fringe of long hairs both above and below along their middle portion.

The abdomen has low broad hooks on segments 2 and 3, followed by low rudiments on 4 to 9. The lateral spines on 7 to 9 are minute but slightly larger on 8 than on 7 or 9. The caudal appendages are half as long as the ninth segment, equal each to each in length.

Two reared specimens, one with a teneral imago and the cast skin from which it had emerged were sent me by Dr. Francis X. Williams. They are labelled " El Salto, Escuintla, Guatemala, issued June 26th 1934 F. X. W." He wrote me that the nymphs were secured from mud or sand in a stream and in a settling reservoir.

Cyclophylla sp. No. 2

Length of body 29 mm., abdomen 20, last segment 6, hind femur 3.5; width of head 4.5; of abdomen 4.5.

This is very similar in size, appearance and in all structural characters to the preceding species, but slightly stouter in stature, and more densely hairy on the antennae and mouthparts externally. The mentum of the labium is a little broader but otherwise similar. There is a single erect tubercle-like dorsal hook on segment 3 of the abdomen, and the rudiments of dorsal hooks on 7 to 9 are a little better developed than in *C. volsella.* The short straight lateral spines on 7 to 9 seem to terminate the hair fringes on the margins of these segments.

There is a single exuvia in the Cornell University collection, from Lassance, Minas Geraes, Brazil, dated " 9–19 Nov. 1919 ".

The two preceding species are the smallest and the slenderest members of the genus.

Cyclophylla elongata supposition (Fig. 9.)

Several exuviae from Vera Cruz, Mexico collected by Sr. J. Çamelo, sent me by Dr. Calvert, are referred to this species by supposition for three reasons: (1) only this species is known from the vicinity of Vera Cruz. (2) They are of the proper size, and (3) Sr. Camelo writes me that he has taken the adult *elòngata* in the same locality. The nymph may be described as follows:

Length 40 mm., abdomen 30, tenth segment 9, hind femur 5; width of head 5, of abdomen 5.

This is a silt coated nymph, with only the end segment and appendages darker brownish. Dorsal hooks are present on abdominal segments 3 to 9, highest on 3 and regularly diminishing in size and flatness to a very small triangular point on 9. Lateral spines on 7 to 9, minute on 7, but evident, slightly larger on 8 than on 9.

A male nymph in the University of Michigan, Williamson Collection from Livingston, Guatamala, Feb. '05 E.B.W. is a little smaller—Length, 37 mm., abdomen 27, length of tenth segment 9.

Cyclophylla viridipleuris supposition (Fig. 8.)

Two exuviae, a male and a female loaned me by Dr. Calvert, bear the suggestive label "*viridipleuris?*" in his handwriting. The supposition is based on his receipt of adults of that species from the same locality and collector: "Irany River, Nova Teutonia, Sta. Catherina Brazil; Fritz Plaumann, Collector". One was collected in November and the other in December.

The female measures 38 mm., ♂ 37; abdomen 29, tenth segment 10, hind femur 5; width of head 5, of abdomen 5.

Another silt coated nymph without color pattern (in the skin; possibly color may be present in the flesh) more hairy on the legs than the preceding species and smaller, and with relatively longer tenth abdominal segment. Dorsal hooks on abdominal segments larger, each showing a decurved point at its tip. The lateral spines of segments 7 to 9, stronger and nearly equal each to each in size or the seventh a little smaller.

Cyclophylla sp. No. 5 (Figs. 6, 21.)

Length 34 mm., abdomen 22 tenth segment 7, hind femur 5; width of head 5.5; of abdomen 7.

This nymph is distinguished from other known nymphs of this genus by having on the abdomen a better development of dorsal hooks and lateral spines (the latter on 6 to 9) and by a color pattern of two broad blackish dorsal bands on segments 4 to 9.

The fourth antennal segment is a long slender upcurving cylindric pointed rudiment longer than segment 3 is wide. The lateral lobe of the labium is strongly narrowed from its base outward to hooks. The dorsal hooks on abdominal segments 2 to 9 are low on 2, high on 3 to 6 and successively lower and broader on 7 to 9. The lateral spines on segments 6 to 9 are strong and sharp, on 6 about half as large as on the other segments. The body is concolorous save for the two submedian blackish bands.

This description is drawn from a nymph just at the point of transformation, with the stripings of the synthorax showing through the transparent skin and wing sheaths expanded by crumpling of the wings within them.

One nymph ready for transformation—Lagôa de Soura; two from Açude de Cedro; one from Açude São Bento; one from Açude Bu, Soura; all in the state of Ceara, Brazil. The last named is a half grown specimen in which the dorsal parallel bands on the abdomen are solid black.

Cyclophylla sp. No. 6 (Figs. 24, 25.)

A single specimen in the collections of the American Museum of Natural History was kindly loaned me for study. In form of labium it departs considerably from that of the preceding species and closely approaches that of a specimen in the Museum of Comparative Zoology from Brazil that I figured in 1911 (Pl. XIV, fig. 5). Since of that specimen only the labium was preserved, this whole nymph enables me to add here some descriptive notes that give further indications of relationship. The specimen bears the label " Acc. 3928: came in with fishes from British Guiana ".

Length 37 mm , abdomen 27, of which its tenth segment alone comprises 12 mm., hind femur 5; width of head 4 5, of abdomen 5.

This is a rather smooth and slender nymph, rather hairy on all lateral margins of body and appendages. The antennae are rather longer and more slender than in the preceding species (3 mm.), with the third joint comprising more than half their length and the fourth a slender cylindric pointed rudiment a little longer than the third is wide. The burrowing hook on the fore tibia is developed as a mere external ridge on the apical margin.

The abdomen is marked by a pair of interrupted blackish longitudinal bands on segments 3 to 9, with dorsal hooks occupying the pale stripe between the bands. These hooks are present on segments 3 to 9, highest on 3, successively smaller to rearward, becoming rudiments on 8 and 9. Lateral spines are present on 6 to 9, well developed and nearly equal on 7 and 8, minute but distinctly sharp pointed on 6 and 9. Caudal appendages nearly equal each to each, and longer than 10 is wide at apex.

' The labium (Fig. 25) is like that of the Brazilian species that I figured in 1911 in the sigmoid curvature of the sharply inturned end hook, but it differs specifically in having a minute tooth in the depths of the notch between that hook and the convex inner border of the lateral labial lobe.

Fortunately this nymph is well enough preserved to show the venation in its developing wings. Ante- and postnodals are 19:12 and 16:13 in fore and hind wing respectively, with the first and sixth thickened in both wings.

Behind the stigma are six crossveins, including the weakly developed brace vein. The triangle in the fore wing is three celled, while both supra- and subtriangles are two celled; in the hind wing the triangle is two celled and the subtriangle is without a crossvein. There are two rows of cells beyond the triangle for a distance of eight cells in the fore wing and six in the hind. There are but four post-anal cells, the two anterior forming an ill defined anal loop, and two additional extending in broken line to the wing margin. Between veins A_2 and A_3, parallel to these post-anals, are first two large cells in front-to-rear series and then two more to the wing margin that are smaller and ajog, with marginal interpolation of added cells, among which the course of vein A_2 is not clear. Since, however, there are generally two full rows and a wider space between veins A_2 and A_3 in *Aphylla* the affinities of this nymph are clearly with *Cyclophylla,* as is also indicated by the labial characters.

Besides the foregoing there are the two described in Cabot 1872, his nos. 10 and 11, and redescribed by Hagen in 1885, his nos. 32 and 34, all conforming rather closely to one type of nymphal structure.

II. Concerning Aphylla caraiba Selys

In a brief note at the end of the original description of the Brazilian *Aphylla producta,* de Selys in 1854 set apart a Cuban species as follows:

> "*Race? Gomphoïdes caraïba,* De Selys. — Couleurs plus nettement dessinées et plus vives. Lèvre supérieure verte, entourée et traversée de brun. Raie humérale plus étroite, l'antéhumérale plus large, l'une et l'autre vertes, notablement confluentes par en haut contre les sinus.
> *Patrie*: Cuba. (Musée de Berlin.)"

The few characters thus given fit very well such specimens of *Aphylla* as I have seen from Cuba. Yet in all subsequent records (including my own) only the name *Aphylla producta* appears.

Fortunately, for illustrating genitalia in Sely's "Monographie des Gomphines" Hagen chose *A. producta* as a representative of the genus. His figures appear in plate 12 of that work: a dozen detailed figures of the separate parts. Comparing them part by part with the dissociated genitalia of one of my Cuban specimens I find none of them in agreement. For example: the auricles on the second segment of the abdomen are not truncated, with denticles on a straight edge, but bluntly rounded with denticles irregularly scattered over the margin. The anterior hamule (Fig. 42) is not twice bent at an angle and at apex recurved, but smoothly curved with the point directed to rearward. The pointed end of the posterior hamule (Fig. 43) does not project straight downward, but is hooked forward. The vesicle of the penis is less elongate downward, etc.

Recently (January 1939) I revisited the Museum of Comparative Zoölogy at Cambridge, and found there a number of adult specimens of *Aphylla*, all agreeing very well with my own Cuban adults, and one of them, a female, bearing the label "*Aphylla caraïba* Type, Mus. Berol, Cuba. Otto". This one measures, abdomen 46 mm., hind wing 38. It is a badly discolored specimen (as are most of the specimens I have seen), but it shows the two pale stripes on each mesepisternum conjoined above in a sweeping curve, the wider anterior one separated from the yellow collar below. The extent of these pale stripes however may be quite variable (as shown by Dr. Calvert for *A. ambigua*, 1905, p. 157). The simple triangular lobes of the subgenital plate are about a sixth the length of the 9th sternum, but these plates do not seem to offer specific differences in this genus.

Two pairs of specimens in Museum of Comparative Zoölogy bear the label in Hagen's handwriting "Cuba, Poey, 1858," but without specific name. Another pair is labelled "Gundlach". A teneral female is labelled "Cienaga Cuba, 7, 1913", a male and three females "Hayti, Samana, Frazar" [Santo Domingo]. Also there is a single male from "Soledad, 13 IX '30, Richard Dow" that is unusually well preserved, showing a fuscous body, brightly striped with yellow on the thorax and the abdomen suffused with reddish brown at both ends. The face also is reddish brown sprinkled with golden hairs. The costa is narrowly edged with yellow: veins otherwise blackish; stigma brown.

There is a lance-shaped yellow basal middorsal spot on the blackish dorsum of segment 8, whose sides below and expanded leaf-like margins are yellow. There is a wide, very shalllow concavity in the apical margin of the yellow 10th abdominal segment above. The appendages are reddish brown, black tipped and blackish at base externally. The hind wing of the specimen measures 35 mm.

At Soledad in 1937 I found on the 27th and 28th of April, exuviae from which imagos had recently emerged. At the same time I saw in flight one adult that was probably of this species (the only other regional Gomphine is the much smaller *Progomphus integer*). When half way across the pond it was seized in mid-air by a kingbird; and I saw no more.

On April 3d, in 1930 I found at Damien, Hayti, exuviae, apparently of the same species. These together with Dow's November record indicate for this species a long season of flight.

All the males agree in having the apex of the superior abdominal appendages prolonged in a minute, sharp, downwardly directed, thorn-like spine as shown in figure 43. and by this are distinguishable from other species here considered. They also are uniformly smaller in stature.

In my opinion *Aphylla producta* does not occur in Cuba at all; and the only species that I know from there is *A. caraiba.* All records of *A. producta* from Florida are doubtful. They probably apply to *A. williamsoni*: and Pollard's specimen from Wilmington, North Carolina,[6] as well.

III. THE NYMPHS OF EPIGOMPHUS AND TWO ALLIED GENERA

Along with the nymphs described and listed in the preceding pages, Dr. Calvert sent some unknown nymphs and exuviae from his collection and kindly gave me permission to describe them. Since three of them represent types of nymphal structure not hitherto made known I gladly accepted the offer. One of them that is represented by a nymph is determinable by the venation of its developing wings as a species of *Cyanogomphus,* probably *C. waltheri* Selys. One of them, *Epigomphus,* from Costa Rica is determined by exclusion. One that was represented only by a single exuvium is probably the nymph of the very archaic genus *Archaeogomphus* but is not positively determinable.

Cyanogomphus waltheri Selys? Nymph (Figs. 27, 28, 29.)

Length, 17 to 18 mm., abdomen 11, hind femur 6; width of head 5, of abdomen 8.

This is a broadly depressed nymph with a subcircular abdomen that is serrately margined with strong lateral spines. A huge middorsal spine on

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[6] Entom. News, XXII, p. 79, 1911.

the 9th segment overreaches the caudal appendages. The body is concolorous, or a little darkened on the margins of the tibiae and along the middorsal spines of the abdomen. The skin is pulverulent where not covered with silt, and is marked with large bare scars as follows: a round pair on the rear of the head, a larger irregular pair on the dorsal disc of the prothorax, and others on the sides of the synthorax above the bases of the legs, and with clusters of several scars midway of the sloping sides of the dorsum of abdominal segments 3 to 9. These latter are repeated in corresponding position on the under side of the abdomen.

The head is widest across the broadly rounded eyes and a little narrowed behind them to the incurving occipital border. The antennae are four-jointed but the fourth joint is so reduced as to be almost wanting. They are hairy along the inner side of the long incurving third segment. Each antenna arises from a broadly truncated prominence of the frons. Each lateral ocellus is elevated above the general level, and is directed laterally. There is a low blunt tubercle on the dorsal side of each of the hind angles of the head. The labium is very short and broad, its hinge reaches backward barely to the synthorax. The mentum is little wider than long. Its width is greatest just beyond the middle and diminishes forward to the base of the lateral lobes. Its median lobe is slightly produced and then subtruncated, and it bears a soft marginal fringe of yellowish hairs The lateral lobe is short with big hooks and with no teeth on its inner margin. The end hook is about half the size of the movable hook and the two are similarly curved. A supporting flange or buttress developed at either side of the mentum on the under side of the head. (See this on the big head of a *Hagenius* nymph as shown in an initial cut on page 31 of my Handbook of the Odonata of North America).

The disc of the prothorax is transversely divided by an arcuate groove, and the portion behind the groove is elevated at the ends into projecting lobes. The synthorax widens broadly to the base of the long hind legs The legs are fringed with soft hairs that are especially dense and conspicuous on the upper edge of the hind femora and on both upper and lower edges of the hind tibiae, but the yellowish tarsi are almost bare above, sparsely hairy below. The latter are 2-2-3 jointed. The tips of the wing cases reach well upon the 6th abdominal segment.

The abdomen is strongly depressed, widest on the sixth segment, and margined by the serrately arranged lateral spines of segments 3 to 8. These spines increase in size to rearward. The spines of 9 are very short and lie close beside the base of 10. The dorsal hooks are very peculiar, forming a very irregular series on segments 3 to 9. They are minute but increasing in size on 3, 4 and 5, large on 6 and 7, reduced to a mere carina on 8 and the spine of 9 is very robust and projects like a horn obliquely backward over 10 and above the caudal appendages. The latter are bluntly tipped; the inferiors are about twice as long as 10 with the superior and the laterals successively shorter.

The above description is from a female cast skin. The male is similar, slightly smaller, and has the rudiments of the genitalia of the segments 2 and 3 of the abdomen plainly indicated on the ventral side.

Seven exuviae (one ♂ and 6 ♀) and a single nymph about ready for transformation were sent me by Dr. Calvert. The nymph bears the label " Brazil, Passo dos Indios, 27° 07′ S., 52° 36′ W. 14-16 Dec. 1936, Fritz Plaumann ": the exuviae, " Irany R., Nova Teutonia, Brazil, 17-18 XII 1936, F. Plaumann ". Two of the exuviae were presented to the Cornell University Collection.

The wings of the single nymph being crumbled within their sheaths, were too far developed for direct examination of the venation developed in them; so I removed one pair and gave them to Dr. May K. Gyger for study by the method of stretching outlined by her in Entomological News, January, 1939. The venation when thus disclosed showed remarkably close agreement with Williamson's figure of the type of *C. waltheri*,[7] from Brazil. His critical notes[8] on the other known species of the genus were of value in distinguishing it from the other species. The generic determination is at least assured; the specific highly probable.

Cyanogomphus sp. (Fig. 32.)

A second species, doubtless congeneric with the preceding, is slightly larger: length, 21 mm., abdomen 11, hind femur 6; width of head 5.5, of abdomen 7.

The lateral spines that margin the abdomen are slightly larger and of more nearly uniform size on segments 3 to 8. The dorsal hooks are very different, in that they form a more regular series, that of the 8th being nearly as large as the one on 7.

Insofar as I can see in the 3 exuviae that have been before me this nymph is otherwise similar to the preceding species, and is therefore referred by supposition to the same genus.

This species is represented by three exuviae in the Collection, kindly sent me by Dr. P. P. Calvert. They come from Nova Teutonia, Santa Catharina, Brazil and were collected by F. Plaumann on November 8, 1935.

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[7] Ent. News, xxvii, pl. viii, fig. 2, 1916.

[8] Ent. News, xxvii, pp. 167-172, 1916.

THE NYMPH OF EPIGOMPHUS (supposition)

(Figs. 30, 31)

Length, 27 mm., abdomen 16, hind femur 5; width of head 5, of abdomen 7.

This is a stout flat nymph with hairy-margined thorax and bare-backed blunt-tipped abdomen. The head is flattened above and broadly rounded behind the eyes to a nearly straight occipital border, before which the posterior sloping surface is streaked with bare longitudinal scars. Antennae are four jointed, the third joint depressed to elongate oval form and very flat, the fourth a minute subspherical rudiment. The crescentic labrum projects laterally at its free hind angles, and its blackened front margin bears a heavy fringe of long hairs. The labium is stout. Its hinge reaches the level of the middle legs. The mentum is more than half as wide at base as at front and the sides are convex. Its median lobe is slightly convex and is armed with seven regularly placed black denticles, and fringed besides with tawny hairs. The lateral lobe is stout. It is fringed externally with long sparse hairs, and armed with a long sharp movable hook. Its end hook is blunt and has the inner margin beset with about a dozen minute denticles. These cover the inner margin up to the apex of the hook.

The prothoracic disc is without the usual laterally projecting lobes, but has two submedian elevations: an oval one before the transverse groove, and a larger U-shaped one behind it. About the bases of all the legs there is a fringe of long tawny hairs. The bare scar lines are fairly well developed on all the legs and on fore and middle legs the burrowing hooks are very strong. The knees and claws are blackened in this specimen. The wing cases reach backward well upon the fifth abdominal segment.

The abdomen has no dorsal hooks at all, and is very broad and flat. Viewed from above it is segmentally serrated, the lateral margins of 6 to 9 ending posteriorly in an angulation (not a spine) that increases in size on successive segments. The relative length of segments 7, 8, 9, and 10 are as 10:9:8:4. The caudal appendages are about as long as 8 is on the middorsal line: the superior and inferiors of about equal length, the laterals a little shorter and outcurved at the tips.

Described from a single male exuvia, collected at a "rivulet near milepost 74½ west of Juan Vinas, Costa Rica, April 27, 1910" by Dr. P. P. Calvert.

This nymph is referred to *Epigomphus* by exclusion, that genus being the only Gomphine genus known from Costa Rica of which no nymphs are known. It also is of suitable size, and it differs from the nymphs of other Gomphines to a degree that corresponds very well with the differences in the adults.

UNKNOWN GOMPHINE NYMPH, POSSIBLY ARCHAEOGOMPHUS

(Figs. 33, 34, 35, 36)

Length, 16 mm., of abdomen 10, hind femur 5; width of head 4.5, of abdomen 6.

This is a rather slender thin-legged nymph, with a depressed parallel-sided abdomen that ends in conspicuous spines on the terminal segments. Its prickly pubescent skin is almost lacking the usual Gomphine bare scars. It shows also more than usual color, there being ill defined U-markings scattered over the terminal segments of the abdomen, and the middorsal hooks being dark brown. The slender legs lack the usual burrowing hooks on the apices of front and middle tibiae; they are fitted for sprawling rather than for burrowing, and there are bands of faint color on the femora.

The head has large eyes set rather farther back than usual, and it is greatly narrowed behind them, and deeply excavate in the rear. A sinuate cross line of brown extends from eye to eye. The antennae are four jointed, the third joint long and cylindric, and the fourth a minute rudiment. The labium is rather small and delicate, its hinge reaches backward to the level of the middle legs. Its mentum is twice as wide at the end as at base, regularly tapering outward. Its median lobe is very slightly produced and its border is fringed with short soft hair. The stout movable hook of the lateral lobe is situated at about midway its length, and the half beyond the hook is about as wide as that before it, and there is no end hook at all, but a broadly rounded tip beyond a long straight inner toothless border.

On the disc of the prothorax a transverse groove divides off an anterior third that is about half as wide as the posterior two thirds; the ends of the latter are raised in two roundly projecting lobes. The skin of the entire dorsum of the thorax is prickly-granulate on all its ridges. The legs are long and thin and nearly bare. Claws are missing from all the legs of the single imperfect specimen, save only for a single very long smooth claw that still hangs pendant on a thread-like tendon from the tip of the long second joint of one hind leg. The tip of this joint seems to bear articulations for two claws, wherefrom I conclude that the tarsi are 2–2–2 jointed—a condition known elsewhere in Odonata only on the near allies of the old world *Gomphidia*. The tips of the wing cases reach backward to the middle of the fifth abdominal segment.

The moderately depressed abdomen is widened backward to segment 4, then nearly parallel sided on 4 to 7, and then abruptly narrowed to the tip. The lateral margins of 4 are regularly serrate with eight small teeth directed to rearward. There are strong subequal lateral spines on segments 7 to 9, those of 7 are slightly divergent: those of 9 are half as long as the tenth segment. There are dorsal hooks on 4 to 9, high, curved backward, sharp-edged, bare and brown, increasing much in length to rearward, the tip of that on 9 overpassing the tip of the tenth segment. On 10 there is a low median prominence. The caudal appendages are a little shorter than the tenth segment; inferiors and superior of equal length, the laterals a third shorter.

One male exuvia from Nova Teutonia, Santa Catharina, Brazil, 7.11.35, F. Plumann, sent by Dr. Calvert.

This nymph is more like a Libelluline than any other known Gomphine in its very large eyes, its thin skin and slender legs, and in its broad lateral labial lobes that are concave.

This nymph, while not generically determinable, is referable to that part of the Gomphine series having but one row of cells beyond the triangle in both wings. That is nearly all that can be made out of the venation weakly shown in the exuvial wing sheaths. Its very small size and the libelluline aspect of its slender legs and somewhat mask-like labium indicate that it may belong to one of the two Neotropical genera belonging here: *Agriogomphus* Selys and *Archaeogomphus* Wmsn. These are the ones most like the very primitive members of other subfamilies, as I pointed out in 1903 (p. 738), and Ris re-emphasized in 1909.[9] It is very gratifying to find the evidence from nymphal structures corroborating that formerly drawn from adult venation alone.

IV. A VENATIONAL KEY TO THE GENERA OF NEOTROPICAL GOMPHINAE

In the course of my efforts to determine the nymphs above described by means of the venation found in their developing wings it has been necessary for me to give close heed to the likeness and differences in the wings of adult representatives of all regional Gomphine genera; and to facilitate determination I prepared for my own use a venational key to the genera, and supplemented it with a verification table. The latter is a great aid because it offers ready comparison of many characters. Thinking that both key and table may be of use to others I offer them herewith.

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[9] Libellulinae Selys Coll., p. 10, figs. 1 and 2.

1. Vein M_3 undulate[10] .... *Ammogomphus*
Vein M_3 smoothly curved to rearward 2

2. One row of cells beyond triangle 3
More than one row of cells beyond triangle 4

3. Basal subcostal crossvein present .... *Agriogomphus*
Basal subcostal crossvein absent .... *Archaeogomphus*

4. Sectors behind Rs conjoined and attached to Rs by a single stalk. *Cacus*
These sectors severally attached to Rs 5

5. Basal subcostal crossvein present 6
Basal subcostal crossvein absent 12

6. Four or more postanal cells[11] in hind wing or if only three, then the proximal cell very large 7
Three or fewer postanal cells in hind wing 10

7. Without supratriangular crossveins .... *Progomphus*
With supratriangular crossveins 8

8. Anal loop of three or more cells .... *Gomphoides*
Anal loop of two cells or wanting 9

9. A_2 running direct to margin .... *Aphylla*
A_2 angulate, distally convergent with A_3 .... *Cyclophylla*

10. Three cubito-anal crossveins .... *Epigomphus*
Two cubito-anal crossveins 11

11. One cell row behind Cu_2 in fore wing .... *Ischnogomphus*
Two or three cell rows behind Cu_2 in fore wing .... *Cyanogomphus*

12. Anal loop strong, of three or more cells; hind wing more than 45 mm. long .... *Zonophora*
Anal loop weak or absent; hind wing less than 35 mm. long 13

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[10] This genus is known to me only from Foerster's description of a single male from Paraguay (*Archiv. f. Naturg.* 80A: 73-74,1914). Foerster compares it with Gomphoides and Herpetogomphus but points out that this undulation, this sag to rearward in Vein M_3 just beyond the nodus, is distinctive. It is not uncommon elsewhere however among the more generalized Anisoptera and it appears weakly in the wings of *Cacus mungo* shown herewith (Figs. 37, 38). Vein M_3 is pushed to rearward (and M_4 a little less strongly along with it) opposite the oblique crossvein, which marks the point of crossing over of the radial sector. I take it that this deflection is the aftermath of the primeval invasion of the median area by the trachea of the radial sector. One may see by comparing fossils with recent forms and generalized with specialized ones, features in Odonate wings that gradually disappear with increasing specialization.

[11] I count the post-anal cells, as did Williamson who named them, on the proximal side of vein A_1 from the hind angle of the triangle to the wing margin.

13. Three or fewer postanal cells in hind wing 14
Four or more postanal cells in hind wing 15

14. Fore wing triangle crossed; two postanal cells in fore wing. *Diaphlebia*

Fore wing triangle open; three postanal cells in fore wing. *Desmogomphus*

15. Cu_1 & Cu_2 parallel in hind wing; three sectors of Cu_2. *Herpetogomphus*

Cu_1 & Cu_2 strongly divergent in hind wing; one sector of Cu_2. *Neogomphus*

VERIFICATION TABLE

	Basal sub-costal cross vein	Ante nodals in fore wing	Post nodals in fore wing	Ante nodals in hind wing	Post nodals in hind wing	Cross veins post arculus, F. W.[12]	Cross veins post arculus, H. W.[12]	Cell rows post triangle, F. W.[13]	Cell rows parallel-ing anal, F. W.[14]	Post anal cell rows, H. W.[15]	Middle fork[16]	Anal loop[17]	Length of hind wing[18]
Agriogomphus	+	13	9	10	11	3	2	1	1	2	sk	0	20
Ammogomphus		18	10	14	11								35
Aphylla	+	23	17	14	15	11	7	2	2	6	var	var	36
Archaeogomphus	0	11	5	8	5	3	3	1	1	2	sk	0	19
Cacus	+	20	11	14	9	10	6	2+	2+	6	sk	+	34
Cyanogomphus	+	15	8	12	5	4	3	2	1	3	sy	0	24
Cyclophylla	+	17	9	13	9	9	5	2	1+	4	sy	+	31
Desmogomphus	0	13	10	9	9	5	3	2	1	3	sk	var	24
Diaphlebia	0	13	11	10	11	6	5	2	1	2	sk	var	29
Epigomphus	+	15	11	11	10	5	4	2	1	3	sk	0	31
Gomphoides	+	20	11	14	11	10	8	2	2	7	sy	+	40
Herpetogomphus	0	14	11	10	10	2	1	2	2	4	sy	0	31
Ischnogomphus	+	14	9	11	9	4	3	2	1	2	sy	0	27
Neogomphus	0	12	10	8	9	2	1	2	1+	5	sy	+	27
Progomphus	+	17	10	12	12	7	4	2	2	5	sy	0	30
Zonophora	0	25	17	15	17	10	4	2	2	5	sy	+	48

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[12] Cross veins between sectors of arculus proximal to middlefork (Mf).

[13] Cell rows beyond triangle in fore wing.

[14] Cell rows parallel with anal vein and posterior to it in fore wing.

[15] Cell rows (or single cells) posterior to triangle, counted along proximal side of vein A_1 from triangle to wing margin.

[16] Middle fork, the first fork in the upper sector of the arculus, symmetrical (sy) or askew forward (sk).

[17] Present (+), absent (0), or variable (var).

[18] Length of hind wing varies with species and individuals.

All numerals in the table are relative, being often derived from single specimens.

V. A New Species of Cacus

The *Legion Lindenia* of de Selys (as first limited by him in 1854) has hitherto been represented in our lists by a single American species *Cacus latro* from British Guiana. To this may now be added a second species apparently belonging to the same genus but very much smaller. The venational characters that readily distinguish this genus are the presence of a well developed trigonal planate in both fore and hind wings, an exceedingly long stigma, a forked radial sector with its hinder branch apparently again forked, but continuing its course to the wing margin directly down the distal limb of the fork (in the oriental members of the *Legion,* down the proximal one), and a well-defined anal loop of several calls. This species may be described as follows.

Cacus mungo new species (Figs. 37, 38, 45, 46, 47, 48.)

Length, 60 mm., including appendages 3.5, abdomen 42, hind wing 34.

Male (somewhat teneral) brownish, with yellow stripes on the thorax and rings on the slender middle abdominal segments. Face yellowish on all its sutures, and sparcely clothed with tawny hairs. Labrum edged and traversed by brown. Head above brownish, including the occiput.

Synthorax brown in front marked with a pair of short and rather broad yellowish stripes that are divergent downward where they do not reach to two yellow streaks on the sides of the collar. Sides of thorax brown with a broad yellow oblique stripe under each wing, isolated below. Legs short, brownish, paler basally and on the tibial comb (Fig. 48). Wings hyaline, washed with brown at the extreme base. The very long stigma yellowish within the bordering veins. Venation is shown in plate XXII, figures 37 and 38.

Abdomen suddenly narrowed beyond the basal segments then slowly widened to 8 then narrowed again on 9 and 19. It is brown marked with yellowish color as follows: a spot on the sides of 2 before the auricle; a dorsal twin spot on the base of 3; a dorsal basal cross band on 4 to 7, narrow on 4 and 5, widening to 7 where it is half the length of the segment; most of the dorsum of 8, 9 and 10, where diffuse (and perhaps reddish in maturity) and the roundly expanded and leaf-like lateral margins of 8. The relative lengths of the last four segments are as 10:7:4:3. The pale superior appendages are long, forcipate, arcuate to near the tips, then parallel, with a sinuate line of some twenty or more black denticles extending the entire length of their opposed inner margins. Inferior rudimentary. Genitalia of the 2nd segment as shown in plate XXII, figures 45 and 46.

Two teneral males in the Cornell University Collection labelled "Moengo, Boven Cottica R. Surinam, May 26, 1927". Collected by Dr. W. T. M. Forbes and Dr. P. P. Babiy, at light on a low island in the River.

This species differs in many characters from *Cacus latro,* that species being much larger (hind wing 45 mm.), with many more crossveins in the wings, and having in the male the superior caudal appendages acutely pointed, and with the line of denticles on its inner margin beginning farther out from the base; also the anterior hamule is more slender and more hooked at its tip.[19]

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[19] See Hagen's figures in his Monogr. Gomphines, plate 16.

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[19] Pagination is that of reprints.

EXPLANATION OF FIGURES

PLATE XX

Fig. 1.—*Cyclophylla volsella,* labium of nymph.
Fig. 2.—*Gomphoides stigmatus,* antenna of nymph.
Fig. 3.—*Aphylla caraiba,* labium of nymph.
Fig. 4.—*Cyclophylla volsella,* antenna of nymph.
Fig. 5.—*Gomphoides stigmatus,* labium of nymph.
Fig. 6.—*Cyclophylla* No. 5 nymph.
Fig. 7.—*Cyclophylla volsella* lateral border of segments 7 to 9 of abdomen of nymph.
Fig. 8.—*Cyclophylla viridipleuris* (?) lateral border of segments 7 to 9 of abdomen of nymph.
Fig. 9.—*Cyclophylla elongata* (?) lateral border of segments 7 to 9 of abdomen of nymph.
Fig. 10.—*Gomphoides bifasciatus* (?) nymph.
Fig. 11—*Aphylla* No. 6, labium of nymph.
Fig. 12.—*Aphylla protracta,* antenna of nymph.
Fig. 13.—*Aphylla* No. 4 nymph.
Fig. 14.—*Gomphoides* No. 4, labium of nymph.
Fig. 15.—*Aphylla williamsoni,* labium of nymph.
Fig. 16.—*Aphylla* No. 5, labium of nymph.
Fig. 17.—*Aphylla* No. 4, median dorsal crest of abdomen of nymph in lateral aspect.
Fig. 18.—*Aphylla* No. 4, labium of nymph.
Fig. 19.—*Cyclophylla volsella,* median dorsal crest of abdomen of nymph in lateral aspect.
Fig. 20.—*Gomphoides bifasciatus* (?), labium of nymph.
Fig. 21.—*Cyclophylla* No. 5, median dorsal crest of abdomen of nymph in lateral aspect.
Fig 22.—*Aphylla protracta,* labium of nymph.
Fig. 23—*Gomphoides* No. 4, median dorsal crest of abdomen of nymph in lateral aspect.
Fig. 24.—*Cyclophylla* No. 6, labium of nymph.
Fig. 25.—*Cyclophylla* No. 6, enlargement of part of mentum of nymphal labium.
Fig. 26—*Aphylla* No. 3, labium of nymph.

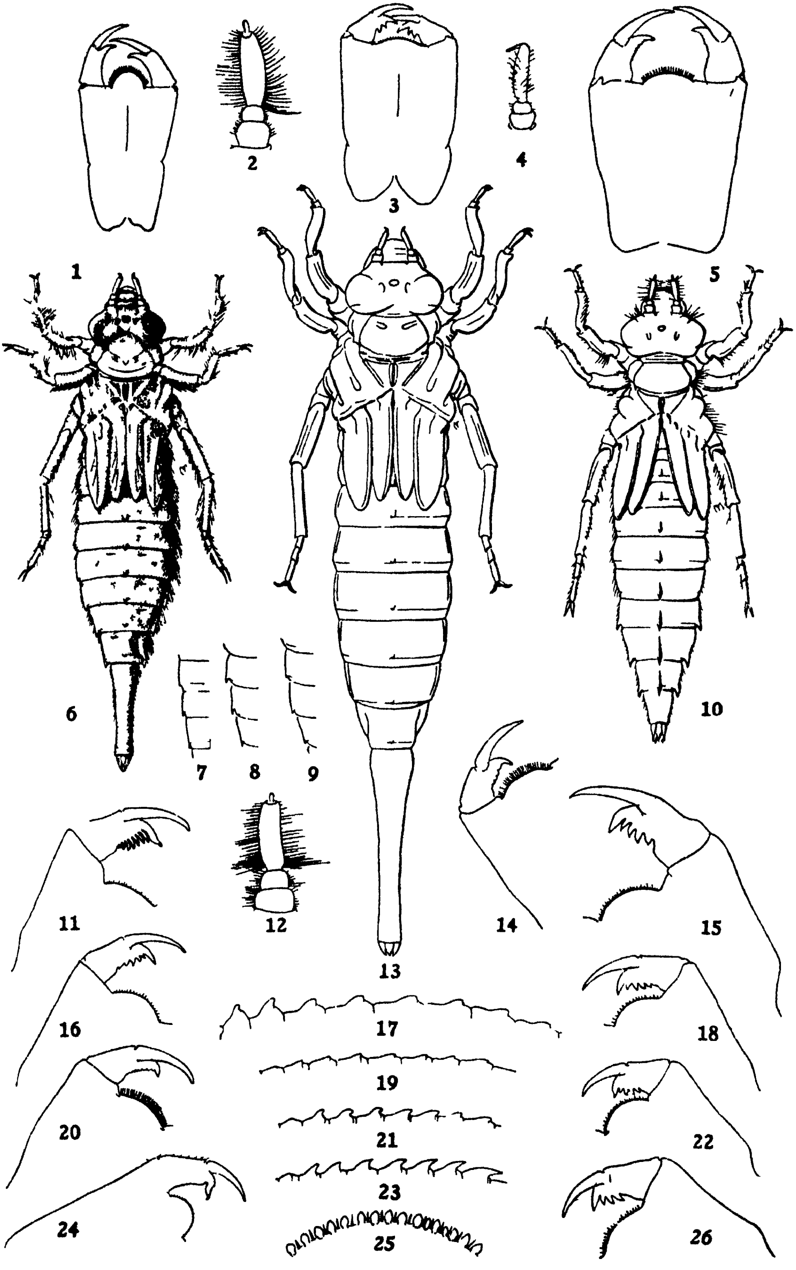
PLATE XXI

Fig. 27.—*Cyanogomphus waltheri* nymph (?), labium.
Fig. 28.—*Cyanogomphus waltheri* (?) nymph.
Fig. 29.—*Cyanogomphus waltheri* (?) nymph, median dorsal crest of abdomen in lateral aspect.

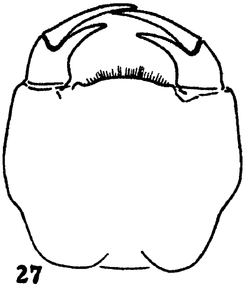
Fig. 30.—*Epigomphus* (?) nymph.
Fig. 31.—*Epigomphus* (?) nymph, labium.
Fig. 32.—*Cyanogomphus* sp. ?, median dorsal crest of abdomen in lateral aspect.
Fig. 33.—*Archaeogomphus* (?), labium of nymph.
Fig. 34.—*Archaeogomphus* (?), lateral border of fourth abdominal segment of nymph.
Fig. 35.—*Archaeogomphus* (?) nymph.
Fig. 36.—*Archaeogomphus* (?), median dorsal crest of abdomen in lateral aspect.

PLATE XXII

Fig. 37.—*Cacus mungo,* front wing.
Fig. 38.—*Cacus mungo,* hind wing.
Fig. 39.—*Gomphoides stigmatus* ♂, base of hind wing.
Fig. 40.—*Cyclophylla volsella* ♂, base of hind wing.
Fig. 41.—*Aphylla caraiba* ♂, base of hind wing.
Fig. 42.—*Aphylla producta,* hamules (after Hagen).
Fig. 43.—*Aphylla caraiba,* hamules.
Fig. 43a.—*Aphylla caraiba,* lateral aspect of tip of left superior anal appendage of male.
Fig. 44.—*Cyclophylla volsella* ♀, base of hind wing.
Fig. 45.—*Cacus mungo,* penis.
Fig. 46.—*Cacus mungo,* hamules.
Fig. 47.—*Cacus mungo,* dorsal aspect of tip of abdomen of male.
Fig. 48—*Cacus mungo,* comb on tibia.
Fig. 49.—*Gomphoides stigmatus,* lateral aspect of tip of abdomen of male.
Fig. 50—*Gomphoides stigmatus,* dorsal aspect of tip of abdomen of male.



NEEDHAM—NEOTROPICAL ODONATA



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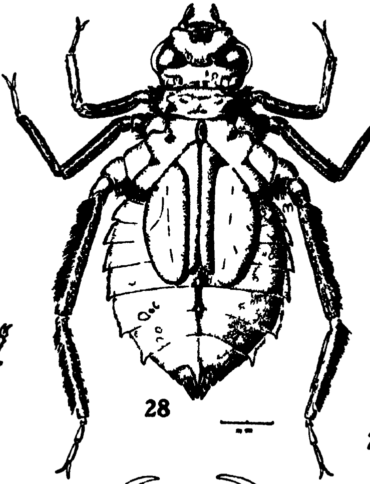

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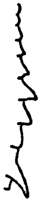

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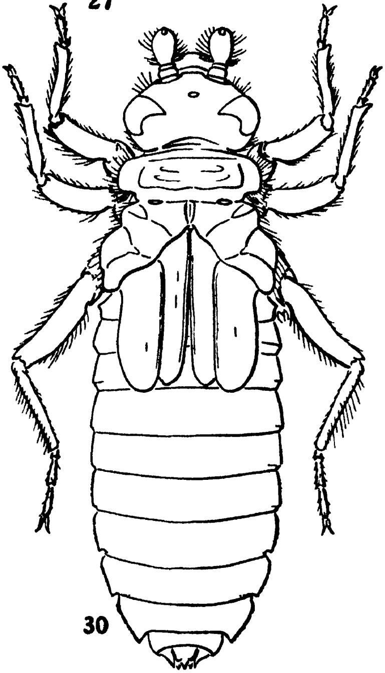

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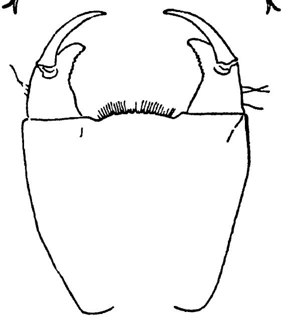

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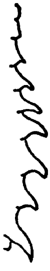

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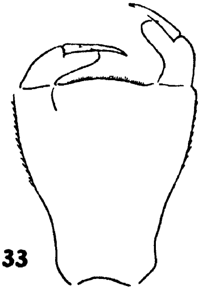

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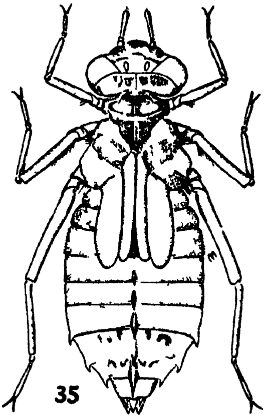

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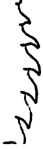

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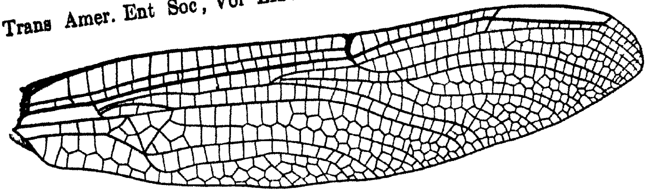

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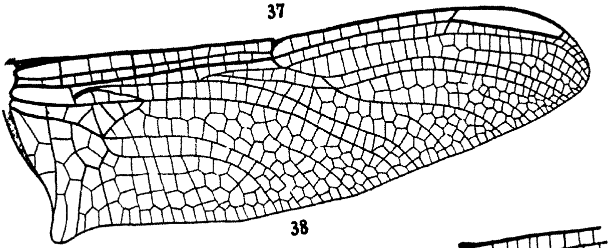

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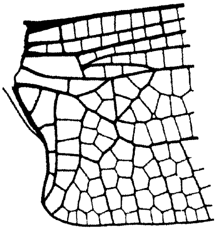

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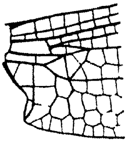

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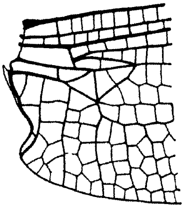

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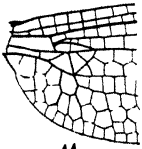

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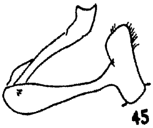

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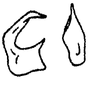

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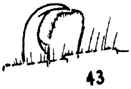

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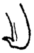

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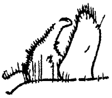

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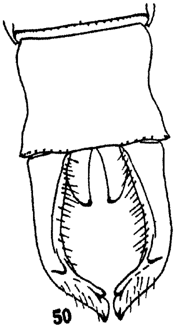

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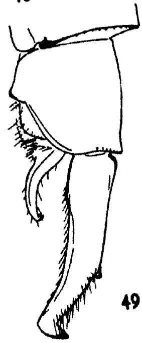

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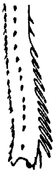

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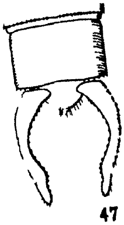

47

NEEDHAM—NEOTROPICAL ODONATA

THE SOUTH AMERICAN SPECIES OF THE OEDIPODINE GENUS TRIMEROTROPIS

(ORTHOPTERA: ACRIDIDAE)

BY JAMES A. G. REHN

Curator of Insects, Academy of Natural Sciences of Philadelphia

(Plate XXIII and text-figures)

The genus *Trimerotropis* of Stål is one of the dominant oedipodine types in the western United States and northern Mexico, where it is represented by a large number of species. In eastern North America its occurrence is much more localized by environmental factors and its speciation is much less marked. As far as present information shows it is absent from Central America south of the Isthmus of Tehuantepec and most of northern South America. It has long been known to occur in Argentine and Chile, but the evidence here presented on the occurrence of the genus in Peru and Ecuador, and discovery of a previously unrecognized Andean subspecies, makes it desirable to review our knowledge of the genus as present in South America.

In determining the relationship of the new form I was under the necessity of examining quite fully the literature dealing with the genus in the area treated, and this work enabled me to ascertain the correct position of *Oedipoda straminea* Erichson, which is referred below to the genus *Lactista,* instead of *Trimerotropis,* as was done previously by Saussure.

To the genus *Trimerotropis* has been referred another South American species, which, however, it is evident from careful study is not properly included in that genus. This is *Oedipoda bivenosa* Scudder,[1] which was later made the type of the new genus

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[1] Proc. Boston Soc. Nat. Hist., XII, p. 339, (1869). [♀ ; Ecuador.]

Diraneura by that author.[2] When the genus was described it was said to be nearest *Psinidia* and *Trimerotropis,* and in 1910 Kirby appeared so uncertain of its position that he gave *Diraneura* generic rank with its single species[3] and also placed the same species with a query under *Trimerotropis*![4] Hebard in 1924 concluded *Diraneura* was not a distinct genus and that *bivenosa* should be assigned to *Trimerotropis.*[5]

With a limited series of specimens of *Diraneura bivenosa* before me it is evident the genus is valid, and that its nearest relationship is with the Nearctic genus *Conozoa* Scudder, with all the forms of which it has been compared. I have also examined the unique type of Scudder's species, which is in the Museum of Comparative Zoology. The general form of the head, and specifically of the fastigium and frontal costa, of the pronotal disk and its carination, sulcation and sculpture, and the general alar structure of *Diraneura* are much nearer *Conozoa wallula* Scudder, the genotype of that genus, than to *T. maritima* (Harris), that of *Trimerotropis.* The very strongly pronounced and tectately elevated intercalary vein of the tegmina and the character of the sculpture of the pronotal disk, with its appreciably sub-bifoveolate condition between the transverse sulci, are definitely characteristic of *Diraneura,* which as far as at present known occurs only in Ecuador.[6] There is no question in my mind but that the *Trimerotropis gracilis* reported from Hacienda de Verde Cruz and Quito, Ecuador, by Giglio-Tos[7] is *Diraneura*

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[2] Proc Boston Soc. Nat. Hist., XXVII, p 208, (1896).

[3] Synon. Cat. Orth, II, p. 246, (1910).

[4] Synon. Cat. Orth, II, p. 255, (1910).

[5] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 175, (1924). Unfortunately Hebard completely overlooked the fact that *Diraneura* was erected by Scudder in 1896, as he credits it to Kirby, 1910, who, however, gave full credit to Scudder.

[6] In addition to the Pifo, Ecuador female, already recorded by Hebard, I have before me the following:

ECUADOR: Mocha, Tunguragua, elev. 3284 meters; (F. Campos); 3♀; [A.N.S.P.]. Cajabamba, Chimborazo, elev. 3205 meters; (F. Campos); 1♀, [A.N.S.P.]. Bucay, elev. 300 meters; (F. Campos; at light); 1♂; [A.N.S.P.].

From the information now before me it is evident the species has an exceptional vertical range in Ecuador, the material before me showing an altitudinal spread from 300 to 3284 meters (or 975 to 10,774 feet).

[7] Bollett. Mus. Zool. Anat. Comp. Torino, XIII, no. 311, p. 39, (1898).

bivenosa, as pointed out by Hebard,[8] and not *T. gracilis*, which is a North American species of relatively limited distribution and definite ecological requirements.

Key to South American Forms of Trimerotropis

A. Bilobation of median carina of prozona of pronotum, as seen in profile, marked, with individual lobes subcristate; metazonal disk of pronotum with lateral shoulders for nearly or fully their cephalic halves definitely carinulate.[9] (General form proportionately robust; wing-band broad, relatively solid and uninterrupted.)
ochraceipennis (Blanchard)

Bilobation of median carina of prozona of pronotum, as seen in profile, much less pronounced, the individual lobes never subcristate, usually not more than carinate; metazona of disk of pronotum with lateral shoulders very briefly, weakly and usually incompletely, if at all, carinate[9]..B

B. Form more slender. Head in cephalic aspect narrower, with more prominent eyes, both dorsad and laterad; genae proportionately less inflated; fastigial excavation narrower. Median carina of prozona of pronotum moderately evident, tectation average. Wing-band broader and unbroken.[10] Caudal femora longer and narrower.
p. pallidipennis (Burm.)

Form more robust. Head in cephalic aspect broader, with eyes less prominent laterad and dorsad; genae proportionately more inflated; fastigial excavation broader. Prozona of pronotum hardly carinate mesad, tectation very low. Wing-band narrow, weak and often broken and incomplete. Caudal femora definitely deeper and stouter
p. andeana new subspecies

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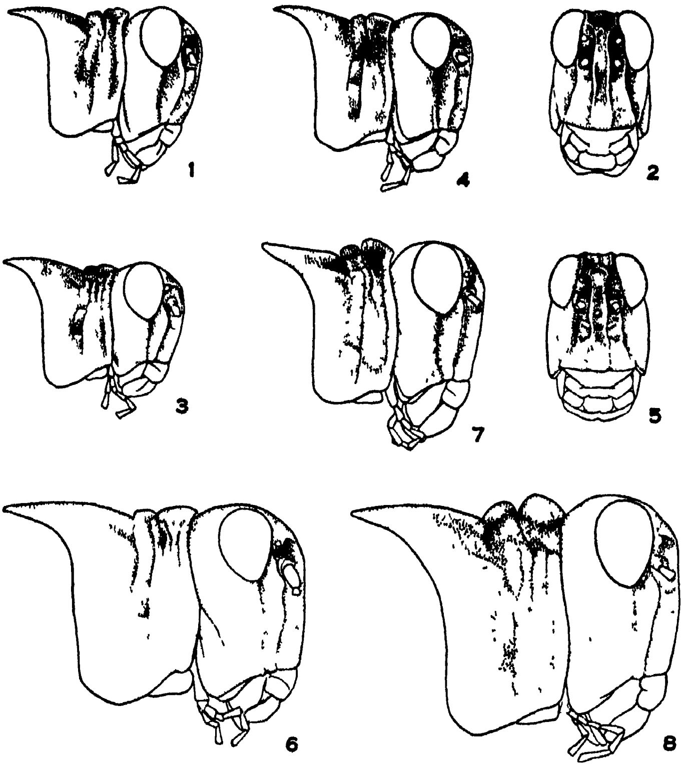
[8] Proc. Acad. Nat. Sci. Phila., LXXVI, p. 175, (1924).

[9] This is an average feature. Occasional specimens violate this, as rarely *p. pallidipennis* and *p. andeana* show carination here almost equal to the average of *ochraceipennis*, but these are distinctly not the mean of their respective forms. Again *ochraceipennis* may have the carination broken into rugulae not definitely continuous. The essential point is that most of the individuals of *ochraceipennis* have this area more definitely and conspicuously carinate than in the bulk of individuals of the other species here considered. The fluctuations noted in this respect are quite within the sculptural emphasis range found in so many species of the Oedipodinae.

[10] In material of *p. pallidipennis* from exceptionally bare and usually alkaline areas the wing-band may be reduced and weakened in conformity with the general bleaching and reduction of all color contrasts. This condition, however, is encountered in but few individual series of the total of some thousands of specimens of the typical race which have been examined.



Explanation of text-figures (All × 4.) *Trimerotropis pallidipennis pallidipennis* (Burm.). Male. Orizaba, Vera Cruz, Mexico. Fig. 1—Lateral view of head and pronotum. Fig. 2—Cephalic view of head. *Trimerotropis p. pallidipennis* (Burm.), atypical. Male. Cerro de la Ciénega, Argentina. Fig. 3—Lateral view of head and pronotum. *Trimerotropis p. andeana* new subspecies. Male (*type*). Oroya, Peru. Fig. 4—Lateral view of head and pronotum. Fig. 5—Cephalic view of head. *Trimerotropis p. andeana* new subspecies. Female (*allotype*). Oroya, Peru. Fig. 6—Lateral view of head and pronotum. *Trimerotropis ochraceipennis* (Blanchard). Male. Angol, Chile. Fig. 7—Lateral view of head and pronotum. *Trimerotropis ochraceipennis* (Blanchard). Female. Angol, Chile. Fig. 8—Lateral view of head and pronotum.

Trimerotropis pallidipennis (Burmeister)

In South America this wide-ranging species breaks into two subspecies, which are here separately discussed.

Trimerotropis pallidipennis pallidipennis (Burmeister)
(Text-figs. 1-3; pl. XXIII, figs. 1 and 2.)

1838. *O[edipoda] pallidipennis* Burmeister, Handb. der Entom., II, abth. II, pt. 1, p. 64. [Sex ? ; Vicinity of Zimapan, Hidalgo, Mexico.]

The established synonymy of the typical subspecies includes *T. vincŭlata* Scudder (1876) and *T. similis* Scudder (1881), both based on material from the North American range of the form. McNeill's *T. salina* (1900) is now considered to be merely a subspecies of *pallidipennis,* restricted to certain areas in North America.

This wide-ranging and quite variable subspecies is one of that interesting group of forms which have marked discontinuous distribution. Almost universally distributed over the western United States west of the eastern edge of the Great Plains except in boreal areas, and occurring from depressions below sea-level to considerable elevations, where the form is often the sole geophilous acridid, it extends southward in arid or semi-arid Mexico at least as far as the state of Oaxaca (Ocotlan).[11] From this point southward it is absent until sub-Andean conditions in southern Ecuador and Peru are reached, where a second area of occurrence is encountered, reaching on the Pacific slope of Peru from as low as Chosica at 2800 feet (854 meters) to as high as Matucana at 8870 feet (2700 meters). While this population of *p. pallidipennis* may or may not be as isolated southward as it presumably is to the northward, a third area, in which the race is apparently as abundant locally as in the western United States, extends from Bolivia at the Argentina border in the vicinity of the Pilcomayo River southward across Jujuy, Salta, Tucuman, Catamarca, Rioja, Mendoza and San Luis provinces to at least the province of San Juan and the territory of Neuquen, and reaches eastward across Santa Fé and Cordoba provinces to the Paraná River at Rosario. For numerous detailed records of this species in this most southern area of distribution, reference should be made to certain papers by Giglio-Tos,[12] Bruner,[13] Hebard[14] and the present author.[15] For information on the North American distribution of the subspecies (usually under the name *T. vinculata*) the student is referred to numerous papers issued during the past thirty-five years by Hebard, Rehn or Rehn and Hebard treating the Orthoptera of various areas of the western United States.

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[11] See Hebard, Trans. Amer. Entom. Soc., LVIII, p. 259, (1932).

[12] Bollett. Mus. Zool. Anat. Comp. Univ. Torino, IX, no. 184, p. 14, (1894) [as *Trachyrrhachis borealis*]: idem, XII, no. 302, p. 26, (1897).

[13] Second Report Merchants Loc. Invest. Comm., Buenos Aires, p. 44, (1900).

[14] Konowia, X, p. 271, (1931).

On the high puna areas of Peru *T. pallidipennis* is represented by an endemic subspecies, *T. p. andeana,* the southward intergradation of which with *T. p. pallidipennis* is discussed under *andeana.* Material referred to *T. p. pallidipennis* from the higher elevations in Peru from which the typical subspecies is here reported, shows marked instability in various features and clear indications of the work of factors or influences which have produced *T. p. andeana.* Certain of this material might be called atypical *p. pallidipennis,* but only in cases where a series has been examined, and the whole agrees in its divergence, have I classed material as atypical, preferring otherwise to discuss the fluctuating tendencies noted in individuals from the locality in question.

Bruner in 1900[16] made the entirely unwarranted statement that the species *pallidipennis* occurs " throughout all of tropical and subtropical South America ", to support which there is to my knowledge no valid evidence. We have as supposed evidence of the occurrence of this species in northern South America, the synonymy of Erichson's *Oedipoda straminea,*[17] from British Guiana, under this species by Saussure,[18] at which time (1884) the latter author also recorded *pallidipennis* from Venezuela. Very extensive series of Acrididae, now in my hands, from Colombia, Venezuela, British Guiana, Dutch Guiana, Amazonian and northeastern Brazil and Amazonian Ecuador, Peru and Bolivia, do not include *T. pallidipennis.* A careful study of the description of Erichson's *Oedipoda straminea* shows but a single feature, not shared by a large number of oedipodids, which could be of value in locating his species. The caudal tibiae are said to be black, beneath the base with a yellow, and in the middle with a paler band. This color pattern is found in no member of the genus *Trimerotropis* or of the closely related genera, all of which I have examined, and with few exceptions personally collected. It is, however, a color feature of other Neogaeic genera of Oedipodinae, and is well developed in the single member of the subfamily known to occur along the northern coast of South America, and of which a series of over fifty specimens, from Costa Rica, Colombia, the Dutch Leeward Islands and Venezuela, is now before me. This species is that described by Saussure as *Lactista pulchripennis*,[19] which name clearly falls for the much older *straminea*, no other species with the type of coloration of the caudal tibiae described by Erichson being known from anywhere in the whole area in which occurs the species here discussed. Saussure describes the caudal tibiae of *pulchripennis* as " coeruleae (in dessicatis flavido et fusco annulatae)." The series before me shows that the dark areas may become blue-black and the median paler band less definite, but distinct contrast is the normal condition, not necessarily due to drying, as I know from personal acquaintance with the species in life. Erichson's name therefore must replace *pulchripennis* of Saussure, the species to be known as *Lactista stramineus* (Erichson).

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[15] Proc. Acad. Nat. Sci. Phila., 1913, p. 322, (1913): idem, 1915, p. 282, (1915).

[16] Second Report Merchants' Loc. Invest. Comm., Buenos Aires, p. 44, (1900).

[17] In Schomburgk, Reisen Brit.-Guiana, III, p. 582, (1848).

[18] Prodromus Oedipod., p. 171, (1884).

Variation.—The same extent of individual variation in general size, color, pattern and tone and relative proportions of alar and femoral length, which is evident in *T. p. pallidipennis* as found in North America, and which has been commented upon in past literature (in part under the name *vinculata*), is similarly found in the considerable Argentine series, as well as that from Mexico, now before me, and to a lesser degree in the smaller representation from Peru.

In the very extensive Hebard collection of North American Orthoptera, a representation of over seven hundred specimens of *p. pallidipennis*, has been selected from a much larger series to show the broad range of variation to be found in that race as present in North America. Using this as a standard it is evident that the light and dark tegminal bars are as a rule contrasted in material from the whole range of the race, but occasionally an over-tint, simulating the environmental background, provides a mantling wash which reduces the normal contrast of the bars. Occasionally the normally pale areas are sprinkled with weak darker areolae, which thus to a degree neutralize the usual contrast of light and dark bars. Again the color-tone response to environmental influences, regardless of what may be the exact mechanism responsible, produces in certain areas, such as alkali flats and similar salines in the western United States, a bleaching out of the normal pattern, and in these the dark tegminal bars may be reduced to the vanishing point. The series from such localities often exhibit persistence to a fair degree of the major elements of the average pattern, and thus we may have a range from virtually barless tegmina to others in the same series with definite but not pronounced bars. These pale extremes in the North American representation are all from areas scattered over the Great Basin in Idaho, Oregon and Nevada, the Mojave Desert and coastal districts of southern California.

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[19] Prodr. Oedipod., p. 143, (1884). [♀; Colombia [in error "Columbia"]; Brazil; Porto Cabello [, Venezuela].]

Similarly in the North American series, the wing-band shows an average width and emphasis over large geographic areas, entirely apart from the extreme condition of the broadly banded *T. p. salina,* which is a more localized form of a definite Great Plains area. The weakest wing-bands in the North American representation are naturally found in those individuals in which the general color tone is palest and least contrasted, i.e. those found in the dazzling glare of alkali flats and saline basins. Thus this condition is probably a response, directly or indirectly, to external factors.

In the Ecuadorian and Peruvian specimens now before me the size is seen to be generally less in both sexes than in the North American, Mexican and Argentinean representations. In the Arequipa and Tia Baya specimens and one of the Loja, Ecuador females, the general tone is paler and more ashy gray than in the others from Peru or the second Loja individual. The darker transverse tegminal bars in the former representations are less solid and more definitely groups of areolae than in the others from the same general area, but individuals from various localities in the Great Basin of the western United States duplicate the same condition. In all of the Peruvian specimens which are spread the wing-band is marked, and in but two males from Matucana is there the faintest suggestion of a break. In one of the Loja females, that from San Bartolome and one from Chosica the band is rather broader than average.

In the table of measurements presented in the treatment of *T. pallidipennis andeana* will be found the dimensions of Peruvian representatives of *T. p. pallidipennis.*

The South American material here listed consists solely of previously unreported series, and is exclusive of previously recorded Argentine representations.

Specimens examined: 53; 29♂, 23♀, 1 juv. ♀.

Typical *T. p. pallidipennis*

Ecuador: Loja, Loja Department; (F. Campos); 2♀; [Hebard Cln.].

Peru: "Quiroz, Rio Paucartambo";[20] IV, 5, 1933; 1♂; [A.N.S.P.]. San Bartolome, Lima Department; (C. T. Brues); 1♂, 1♀; [M.C.Z.]. Chosica, Lima Department; VI, 9-10, 1914; (H. S. Parish); 5♂, 2♀; [A. N.S.P.]. Matucana, Lima Department; VI, 14-16, 1914; (H. S. Parish); 7♂, 1♀, 1 juv. ♀; [A.N.S.P.]: elev. 7300 feet; VI-VII, 1913; (C. T. Brues); 1♀; [M.C.Z.]. Arequipa, Arequipa Department; VIII, 21; (T. D. A. Cockerell); 1♂; [A.N.S.P.]. Tiabaya, Arequipa Department; VIII, 19; (T. D. A. Cockerell); 1♂; [A.N.S.P.].

Argentina: Tucuman, Tucuman Province; XI, 20, 1913; (Estac. Experim. Agron.); 1♂; [A.N.S.P.]. Catamarca, Catamarca Province; (M. Gomez); 1♀; [Mus. Nac. Argentina]: 1♀; [Hebard Cln.]. La Rioja, Rioja Province; 1916; (E. Giacomelli); 5♂, 3♀; [A.N.S.P.]: 6♂, 9♀; [Univ. of Penna.]: (M. Gomez); 1♀; [Mus. Nac. Argentina]. Nequen; 1907; (Dr. Lendl Adolph); 1♂, 1♀; [Hebard Cln.].

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[20] I am unable to find on any of the number of important maps of Peru available, any locality by this name in the Paucartambo Valley. I feel the printed locality, which was on the specimen when it reached the Academy, is an erroneous transliteration of a long-hand label. It is possible Piros, on the Rio Alto Madre de Dios, near the junction of that stream and the Rio Manu, may be intended, as a trail into the Rio Alto Madre de Dios, starts from the Paucartambo Valley. If this should be correct it carries *T. p. pallidipennis* to the eastward of the Andes. However, lacking definite evidence as to the locality I refrain from making any deduction involving this specimen.

Atypical *T. p. pallidipennis*

ARGENTINA: Cerro de la Ciénega, San Juan Province,[21] elev. 3700 meters; (P. Jorgensen); 3♂; [A.N.S.P.].

Trimerotropis pallidipennis andeana[22] new subspecies
(Text-figs. 4-6; pl. XXIII, figs. 3-5.)

This geographic race can be distinguished from *T. pallidipennis pallidipennis* by its proportionately more robust build, with the head broader and less compressed than in the typical form, the genae more inflated, and the eyes less prominent both dorsad and laterad, and in the male by the fastigial excavation being broader. The median carina of the prozona of the pronotum is also very definitely lower with the bilobation much less evident than in *T. p. pallidipennis*, and the transverse tectation of the prozonal disk is appreciably less pronounced. The wing-band is narrower and averages weaker than in *T. p. pallidipennis*, usually broken and definitely less solid and less extensive. The caudal femora also average proportionately deeper and stouter than in *T. p. pallidipennis*.

Type.—♂; Oroya, Department Junin, Peru. Elevation, 12178 feet. June 20, 1914. (H. S. Parish.) [Academy of Natural Sciences of Philadelphia, Type no. 5621.]

Differing from *T. p. pallidipennis*[23] in the following features:

Size relatively smaller than average of *T. p. pallidipennis;* form more robust and less elongate. Head in cephalic aspect with width across genae slightly broader than width across eyes (as 3 to 2.7, as against 2.7 to 2.8 in *T. p. pallidipennis*), the genae moderately inflated; eyes in cephalic aspect less inflated and not as prominent laterad and not definitely elevated dorsal of the fastigial level, in profile the eye outline being more ovoid than subelliptical; fastigial disk as seen from dorsum proportionately broader, the greatest width of the same to the width of fastigium at junction with frontal costa, and to the total width across the eyes being, in *T. p. andeana* as 17 to 10 to 60, as against 20 to 13 to 59 in *T. p. pallidipennis;* frontal costa slightly broader and less finely carinate laterad than in *T. p. pallidipennis*. Antennae proportionately thicker and more incrassate than in the latter.

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[21] My colleague Dr. José Liebermann, of Buenos Aires, to whom I appealed for help in placing this locality, which I was unable to find on a number of large scale charts, writes, "The Cerro de la Ciénega is situated in the Province of San Juan, in the Department of Ullún".

[22] Of the Andes, in allusion to its regional association.

[23] For direct comparison a male individual from Orizaba, Vera Cruz, Mexico, in the Hebard Collection, has been used to represent the typical subspecies.

Pronotum as seen from dorsum less strongly sellate than in *T. p. pallidipennis*, the lateral decurvature of the prozonal surface less strongly indicated and the deplanation of the metazona in consequence less sharply contrasted; in profile the median carina of the prozona is less definitely elevated than in *T. p. pallidipennis* and but shallowly bilobulate, the delimiting incisions much less sharply cut.

Caudal femora proportionately somewhat more robust than in *T. p. pallidipennis*, in type greatest depth to length being as 2.6 to 9, while in *T. p. pallidipennis* a mean is as 2.4 to 9.

Allotype.—♀; same data as type. [Academy of Natural Sciences of Philadelphia.]

Differing from the female of *T. p. pallidipennis*[24] in the same respects as does the male, with the following modifications or additions:

Head with width across genae very appreciably, instead of slightly, broader than width across eyes (as 3.9 to 3.5, as against 4.1 to 3.4 in *T. p. pallidipennis*), the inflation of the genae relatively marked; fastigial disk proportions and frontal costa essentially as in female of *T. p. pallidipennis*.

Coloration.—The series of *T. p. andeana* before me, although it consists of but twenty-eight individuals, shows almost the whole range of general color tone and tegminal pattern strength to be seen in any extensive representation of *T. p. pallidipennis*. In the males of the Oroya series alone the transverse barring of the tegmina ranges from strongly emphasized and solid (see plate XXIII, figure 4) to an opposite extreme in which the barring is much less evident and very largely made up of groups of areolae. In all the females seen the tegminal barring is definitely less contrasted than in the majority of the males, those from Puno and one of the two from Huancayo particularly having the tegminal pattern very weak. The Oroya series as a whole has the dark elements of the color pattern fuscous, sometimes quite deep, and in the Panao and Sajama males there is a very definite contrast to the pattern, even in one from Sajama with an areolar tendency to the dark bars. The Huancayo and Puno individuals have a more reddish general suffusion than is seen in any of the others. The wing disk is greenish yellow in all the specimens, and the wing-band is always definitely weaker, narrower and less complete a unit than in any series of *T. p. pallidipennis* except ones selected from alkali and similar areas. The wing-band in *T. p. andeana* is definitely less extended about the periphery of the radiate field toward the base, always, even in those with the darkest and otherwise most clearly defined wing-bands, with a definite, or at least intimated, break at the humeral spur, which latter is as evident and extensive as in *T. p. pallidipennis*. In several of the individuals from Chosica and Matucana, Peru, which I have referred to the latter race on account of their much closer agreement in the bulk of their features, we find wing-bands which for width, emphasis and degree of completeness are hardly different from the heaviest band seen in the Oroya series. Structurally, however, these specimens are *T. p. pallidipennis.*

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[24] A female of this race from Peñon, D. F., Mexico, in the Hebard Collection, has been used as a basis for comparisons.

Measurements (in millimeters)

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur	Ratio of greatest femoral depth to length
♂ *T. p. pallidipennis*					
San Bartholome, Peru ...	18.7	3.91	20.2	9.94	—[25]
Chosica, Peru	18	3.58	20.3	9.78	.291
Chosica, Peru	19.8	3.91	21.2	10.43	.280
Matucana, Peru	19.5	3.58	19.8	9.94	.293
Matucana, Peru	21.7	4.07	22	10.59	.291
Arequipa, Peru	16.7	3.42	19	9.61	.270
Cerro de la Ciénega, Arg.	16.6	3.42	18.7	9.29	.298
♂ *T. p. andeana*					
Panao, Peru	17.9	4.07	19.7	9.94	.294
Oroya, Peru, *paratype* ...	18	4.07	17.2	9.45	.327
Oroya, Peru, *type*	18.4	4.07	18.5	10.26	.285
Oroya, Peru, *paratype* ...	18.9	4.72	20.3	10.26	.309
Puno, Peru	16.9	4.07	19.4	9.94	.299
Sajama, Bolivia	15.8	3.34	18.2	8.63	.310
Sajama, Bolivia	17.9	3.66	18.4	11.24	.246
♀ *T. p. pallidipennis*					
Loja, Ecuador	27.3	5.37	28.5	13.20	.283
San Bartholome, Peru ...	28.3	5.37	29.6	14.18	.275
Chosica, Peru	26.8	4.72	26.4	12.87	.278
Matucana, Peru	26.5	4.56	26.4	12.06	.283
Matucana, Peru	25.1	4.72	23.9	11.73	.291
♀ *T. p. andeana*					
Oroya, Peru, *paratype* ...	27.7	4.89	25.2	12.87	.290
Oroya, Peru, *allotype* ...	28.1	5.70	26.2	12.87	.316
Puno, Peru	27.5	5.54	25.2[26]	12.55	.324
Puno, Peru	22.8	5.70	24.4	12.87	.290

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[25] Shrunken in drying.

[26] Apex damaged and measurement slightly less than perfect tegmen.

Structural variation notes.—As the preceding table of measurements shows there is a considerable size range in this subspecies, for although it averages more robust than the individuals of *T. p. pallidipennis* from Peruvian localities, in size alone the series overlap. The Oroya series shows some plasticity in the width of the fastigial disk, although this is clearly broader in every male seen, varying, however, in the actual width. The frontal costa shows appreciable variation in its exact width and the emphasis of its sulcation. The prozonal median carina in an occasional specimen (one from Oroya) is definitely higher and more bilobate than in the others, but even in these it is not developed to the degree found in typical *T. p. pallidipennis.* As with the majority of forms of the genus we find some indication of individual variation in the proportionate length and breadth of the tegmina and wings. The Oroya male which has already been noted as having a more pronounced wing-band than the others of that sex from that locality, has proportionately longer and narrower tegmina and wings, while this tendency is also indicated, but less definitely, among the females from Oroya. The plasticity in proportions of the length and depth of the caudal femora is evidenced by the measurements already given, which, however, show the average stouter structure of this area than in the same sex of *T. p. pallidipennis.* The variational range in the femoral proportions is what is found in most of the forms of the genus *Trimerotropis,* an exceedingly plastic and unstable group.

Paratypes.—In addition to the type and allotype, I have before me nine males and three females taken at Oroya, Peru, by H. S. Parish, July 20 and 21, 1914, and these are here considered paratypes.

Distribution: —In its fully typical condition *Trimerotropis pallidipennis andeana* is before me from four localities, all at relatively high elevations, in Peru, i.e. Andes at Panao, Huanuco Department (2520 meters [=8267 feet]); Oroya, Junin Department (12178 feet); Huancayo, Junin Department (3340 meters [=10958 feet]), and Puno, Puno Department (3950 meters [=12959 feet]). South of this definitely Peruvian Andean area the subspecies occurs in Bolivia, but there the race is atypical, at least the material available clearly shows indications of divergence toward *T. p. pallidipennis.* The locality represented by this atypical material is Sajama, Bolivia (4000 meters [= 13123 feet]), while on the Cerro de la Ciénega, Argentina (3700 meters [= 12138 feet]) we find representatives to be atypical *T. p. pallidipennis.* In addition while the Oroya, Peru series is as a whole perfectly typical of *T. p. andeana,* one of the males shows a narrower head and somewhat higher prozonal carina than the others, indicating some little instability at that point. It is quite possible that only at the highest elevations where the genus occurs in Peru is *T. p. andeana* found completely uniform in its relatively marked distinguishing features, although the youth of the subspecies may account for the apparent instability noted.

Remarks.—It is evident that *T. p. andeana* is a high level representative of *pallidipennis* in at least part of the Puna region of Peru, apparently become less clearly marked as one goes southward. The four males from Sajama, Bolivia, have an average narrower head with less inflated genae, slightly more prominent eyes and narrower fastigium, while in them the height of the prozonal carina and the relative proportions of the caudal femora also show definite instability. The wing-band of these in width and emphasis is nearer the norm of *T. p. andeana* than it is that of the typical subspecies. In addition all four of the Sajama individuals are quite small, which is also true of the three males from the Cerro de la Ciénega, Argentina, which I am considering atypical *T. p. pallidipennis.* Between the Sajama individuals and those from the Cerro de la Ciénega there is a very definite gap, the latter having the heads distinctly narrower and the prozonal carina more elevated, although the wing-band is essentially the same in the two lots. Apparently size is influenced by factors other than those governing the subspecific differences; probably altitude alone, with its accompanying rigorous conditions, is responsible for the depauperation. Thus it is evident that southward *T. p. andeana* shows a tendency toward and presumably passes into *T. p. pallidipennis,* as in mountain areas of Argentina the individuals are *p. pallidipennis* with a tendency toward *T. p. andeana.* Doubtless sufficiently extensive material from a number of localities at varying elevations in Bolivia and

Argentina would show a regular passage from one form to the other.

While the material from the Pacific slope of Peru here referred to *T. p. pallidipennis* shows almost uniformly smaller size than the average of that race elsewhere, and in a few other respects suggests the Puna *T. p. andeana,* it is as a whole clearly *T. p. pallidipennis,* and exhibits less approach toward *T. p andeana* than the atypical Bolivian individuals of the latter do to the typical subspecies. This may indicate that the stock giving rise to *T. p. andeana* invaded the Peruvian Puna from the south, as the higher levels became inhabitable toward the close of the Pleistocene, and that the Puna colonization was less likely to have been from the Pacific slope of Peru, where the moister Pleistocene conditions had doubtless restricted the range of the species as a whole.

Specimens examined: 24; 17 ♂, 7 ♀.

Typical *T. p. andeana*

PERU: Andes at Panao, Department of Huanuco, elev. 2520 meters; IX, 19, 1937; (Felix Woytkowski); 1 ♂, [A.N S P.]. Oroya, Department of Junin, elev. 12178 feet; VII, 20 and 21, 1914; (H. S. Parish); 10 ♂, 4 ♀ (*type, allotype* and *paratypes*); [A.N S P]. Huancayo, Department of Junin; VI, 27 and 28, 1914; (H S. Parish); 1 ♂, 1 ♀; [A.N S P]. Puno, Department of Puno; VI, I (1) and 2 (1) 1875; 1 ♂, 2 ♀; [M.C.Z. and A.N.S.P].

Atypical *T. p andeana*

BOLIVIA: Sajama, Department of Oruro, elev. 4000 meters; 4 ♂; [Hebard Cln.].

Trimerotropis ochraceipennis (Blanchard)
(Text-figs. 7 and 8; pl. XXIII, fig. 6.)

1851. *Oedipoda ochraceipennis* Blanchard, in Gay, Hist. Fis. Polit. Chile, Zool, VI, p. 77, Atlas Zool, Ortopt. pl. 2,[27] fig. 8, 8 a-d. [♀; Santiago and Santa Rosa, Chile.]

1851. *Oedipoda cinerascens* Blanchard, in Gay, Hist. Fis. Polit. Chile, Zool, VI, p. 78. [Apparently ♂ (from measurements); Chile.]

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[27] The copy of the zoological atlas of Gay's "Historia" in the Library of the Academy has but one plate (Lam. I) of Orthoptera, so I am unable to verify the figure numbers or consult these illustrations. Scudder has already noted that of four copies of the atlas examined by him none had more than a single plate of Orthoptera (see Proc. Amer. Acad. Arts & Sci., XXXIV, no. 17, p. 473, (1899), under discussion of *Schistocerca cancellata*).

1861. *Oedipoda placida* Stål, Kongl. Svenska Freg. Eugenies Resa, Zool., 5, p. 344. [Sex not stated but from measurements both sexes were probably examined; Valparaiso, Chile.]

The synonymy given above is clearly evident from a study of the descriptions and the material before me. That of *placida* was first established by Saussure,[28] and *cinerascens* was synonymized by McNeill.[29] Saussure at that time erred in placing Blanchard's *Oedipoda signatipennis* as an additional synonym, as this is clearly a truxaline form,[30] now referred to the genus *Scyllinops*.

This species shows to a very marked degree the range in color pattern and tone which can be found in a single species of *Trimerotropis*. From individuals with a poorly contrasted pattern of ochraceous-buff and buckthorn brown we find a tonal range through those strongly washed with brick red to an opposite extreme having a general tone of blackish fuscous, almost concealing the normal tegminal pattern. The range in the definition of the three transverse, and usually evident, tegminal bars is considerable, in emphasis as well as in the degree to which the bars are relatively solid or clearly made up of groups of annuli. In addition to these features there are two clearly emphasized pattern features occasionally present, which are probably genetic. These are, first, a pale ochraceous edging to the caudal margin of the disk and of the lateral lobes of the pronotum, combined with a pale lineation of the greater part of the anal field of the tegmina, which is found in the material before me in a female from Angol, Chile and another from the Province of Valparaiso; and second, broad subcruciform paler ochraceous bars laterad on the pronotal disk, these being definitely broken mesad and following the usual position of lateral carinae, combined with a marked contrast of the pale banding of the caudal femora. But two specimens, both females, from Angol, show this last mentioned striking pattern, which in none other is even faintly indicated.

The males as a whole show much less color variation than the female, except for a fair range of tonal depth and pattern emphasis, although one male, from Los Maitenes, has the whole pattern more strikingly contrasted than in any other individual of the species before me, the transverse bands sharply cut, the greater part of the pronotal metazona contrastingly ochraceous, the face largely fuscous and the genae marked with hairy white, the femoral barring also of very decided contrast (in this as in the females which have the pale pronotal subcruciform pattern). We have no other male from the same locality, but three females from Los Maitenes are not at all contrasted, although one is more definitely washed with brick red than any other seen. It is quite possible that the pattern of this Los Maitenes male, which strongly suggests that seen in certain North American species of the genus, is also genetic in character and history.

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[28] Prodr. Oedipod., p. 173, (1884).

[29] Proc. U. S. Nat. Mus., xxiii, p. 411, (1901).

[30] See Rehn, Proc. Acad. Nat. Sci. Phila., 1906, p. 49, (1906).

The series of this species now before me clearly supports what field experience has taught me in relation to certain of the North American species of the genus, i.e. that the degree of alar development (as shown by tegminal and wing length) may vary individually in the same sex and at the same place, and also that the exact ratio of greatest depth to length of the caudal femora similarly varies individually. Representative individuals of both sexes show the following measurements (in millimeters) and ratios of femoral depth to length.

	Length of body	Length of pronotum	Length of tegmen	Length of caudal femur	Ratio of greatest femoral depth to length
♂, Angol	18.4	3.4	17.9	9.9	.262
♂, Angol	20.2	4	20.2	10.7	.287
♂, Angol	23.4	4	22.4	11.7	.277
♂, Los Maitenes	19.3	3.9	21	10.5	.276
♂, Los Maitenes	20.7	3.9	22.1	11.5	.284
♀, Angol	28.5	5.2	27.8	14.5	.258
♀, Angol	31.2	5.8	28.5	14.3	.261
♀, Angol	30.4	6	30.1	16.3	.280
♀, Rancagua	26.8	5.7	29.8	15.1	.280
♀, Valparaiso Prov.	25.4	5	24.6	13	.287
♀, Valparaiso Prov.	29.6	5.8	29.6	16.3	.270

The above measurements of length of body, pronotum, tegmen and caudal femur give the extremes found in the series examined.

Distribution.—This species is, as far as at present known, confined to Chile. The previously published records cite it from Santiago, Valparaiso, Valdivia, Santa Rosa (but which of several cannot be determined) and Chañarcillo,[31] the last mentioned in Atacama Province, and, if properly determined, representing the most northern point from which the species is known. The material before me is from areas chiefly to the south of Santiago, and with previous information shows a distributional area extending from Atacama to Valdivia provinces, or approximately from 26 to 40° S. Certainly in at least the southern half of this territory the species is quite generally distributed in suitable environments.

Specimens examined: 60; 18 ♂, 38 ♀, 4 immat. individuals.

CHILE: Valparaiso Province; (A. Faz); 1 ♂, 5 ♀; [Cornell Univ.]. Los Maitenes, near Santiago, 1100 meters elev.; II, 15, 1932; (D. S. Bullock); 2 ♂, 3 ♀; [A.N.S.P.]. Melipilla, Santiago Prov.; XII, 1903; (C. S. Reed); 1 ♂; [A.N.S.P.]. Rancagua, O'Higgins Prov.; XII, 1903; (C. S. Reed); 1 ♂, 2 ♀; [A.N.S.P.]. Cachapoal; XII, 1903; (C.S. Reed); 1 ♀; [A.N.S.P.]. Rengo, Colchagua Prov.; XII, 1903; (C.S. Reed); 1 ♀; [A.N.S.P.]. Talca; I, 1905; (C. S. Reed); 1 ♀; [A.N.S.P.]. Talcahuano, Concepcion Prov.; XII, 1903; (C. S. Reed); 1 ♂; [A.N.S.P.]. Penco, Concepcion Prov.; XII, 1903; (C. S. Reed); 1 ♀; [A. N. S. P.]. Concepcion; II, 10, 1904 (on one specimen); (C. S. Reed); 1 ♂, 2 ♀; [A. N. S. P.]. Coronel, Concepcion Prov.; I, 1904; (C. S. Reed); 1 juv. ♀; [A.N.S.P.]. Angol; I, 1-26, III, 10, IV, 4, V, 10, XII-20-28, 1924, 1927, 1928, 1929, 1931 and 1932; (D. S. Bullock); 7 ♂, 19 ♀, 3 juvs.; [A. N. S. P.]. Cerros de Nahuelbuta, near Angol, elev. 500 meters; I, 1, 1934; (D. S. Bullock); 1 ♂, 1 ♀; [A.N.S.P.]. Mulchen, Bio-Bio Prov.; III, 4, 1921; (Hector Pinochet); 1 ♂; [A.N.S.P.]. Chiguaihue Hills, west of Collipulli, Malleco Prov.; V, 14, 1931; (D. S. Bullock); 1 ♂; [A.N.S.P.]. Victoria, Malleco Prov., II, 13, 1929; 1 ♀; [A. N. S. P.]. Galvarino, Cautin Prov., III, 1927; 1 ♀; [A.N.S.P.]. Boroa, Cautin Prov., III, 10, 1926; 1 ♀; [A.N.S.P.].

Probable history of the genus in South America

The pronounced specific development, diversity and environmental adjustment of the genus *Trimerotropis* in the Nearctic region, entirely aside from the occurrence of numerous related and equally plastic genera in the same area, points very definitely to North America as the original home of the genus. While there it exhibits its greatest diversity in arid and semi-arid regions, it is by no means absent from more humid districts, requiring chiefly the proper environmental conditions for its presence. More distinct forms of *Trimerotropis* are known from the United States east of the Great Plains than from all of South

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[31] See Porter, Rev. Chilena Hist. Nat., III, p. 181, (1899).

America. From west of the eastern border of the Plains between thirty and forty species have been recognized, full revisionary treatment being necessary to determine the exact number.

From the steadily accumulating geological and paleontological evidence it is now clear that there was little penetration of South America by more northern types prior to the Pliocene, as the Miocene of southern South America, from its mammalian evidence, contained one of the most distinctively autochthonous fauna which has existed. As Scott has pointed out horses did not reach South America until the Pliocene, coming from the north, where their evolution had been long continued and complex.[32] As shown by the same author no llamas occurred in South America before the Pleistocene, but in deposits of that period in Ecuador, Brazil and Argentina, they have been found abundant. Similarly no deer have been noted in South American deposits older than the Pleistocene, but he adds that " in view of the degree of specialization which they have there undergone, it is probable that the immigration took place in the Pliocene ".[33] In summing up the general relations of South American deposits, the same distinguished student of South American paleontology says: [34] " the latest Pliocene fauna, that of the Tarija Valley in Bolivia, was essentially the same as that of the Pleistocene and contained a similarly large proportion of migrant elements from the north, but it was evidently older and many of the species were different." As to the extent to which the Andes may have acted as a barrier to the distribution of certain types, Scott states that, " in the upper Miocene the Andes stood at a much lower level than they do now," [35] and gives paleobotanical evidence to support this conclusion, while in discussing the Pliocene Paraná formation of the Argentine province of Entrerios it is emphasized that a few northern hemisphere mammals in the Paraná beds show that the migration had advanced far into South America." [36] Further as to orogenic movements of the Andes it is affirmed that " the final upheaval of the southern mountains took place at some time later than the early Pliocene."[36]

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[32] Scott, W. B., Land Mammals of the Western Hemisphere (1913), p. 307.

[33] Scott, W. B., Land Mammals of the Western Hemisphere (1913), p. 416.

[34] Scott, W. B., Land Mammals of the Western Hemisphere (1913), p. 225

[35] Scott, W. B., Land Mammals of the Western Hemisphere (1913), p. 124.

[36] Scott, W. B., Land Mammals of the Western Hemisphere (1913), p. 128

From these conclusions of one of the greatest of geological authorities, it is reasonably warranted to assume that the genus *Trimerotropis* probably first penetrated South America in the Pliocene, that the isolation of possibly the first invasion in the present Chile by the last great elevation of the Andes resulted in the development there of the endemic *T. ochraceipennis,* while conceivably a second wave brought in *T. pallidipennis,* then widely distributed over grassland and semi-steppe conditions to the northward, and that this form then spread widely over those areas of South America to which environmentally it was fitted. The advent of Pleistocene conditions, with lower temperatures and increased humidity, would then have acted as a restricting factor, reducing markedly the area of distribution, doubtless even much below that occupied today, and probably extirpating the species, and incidentally the genus, in Central America, and possibly in Colombia. The amelioration of Pleistocene conditions and the consequent availability of high Andean areas previously uninhabitable and which now exhibit "Puna" conditions, paved the way for the reoccupation of territory where we now find *T. p. andeana* characteristically developed. The broad adaptability of *T. p. pallidipennis,* as evidenced by studies already carried out in North America, is clearly reflected in its present distribution over semi-arid Argentine steppe and dry Pampas and the semi-arid western slope of Peru. The apparent absence of *T. p. pallidipennis* from other areas of South America is doubtless due to the restriction or complete absence of the requisite environmental conditions.

EXPLANATION OF PLATE XXIII

Fig. 1.—*Trimerotropis pallidipennis pallidipennis* (Burm.), atypical. Male. Cerro de la Ciénega, Argentina. Dorsal view. (× 1½.)

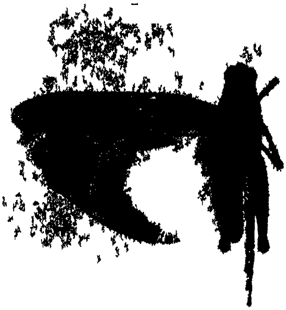
Fig. 2.—*Trimerotropis pallidipennis pallidipennis* (Burm.). Female. Chosica, Peru. Dorsal view. (× 1½.)

Fig. 3.—*Trimerotropis pallidipennis andeana* new subspecies. Male (*type*). Oroya, Peru. Dorsal view. (× 1½.)

Fig. 4.—*Trimerotropis pallidipennis andeana* new subspecies. Male (*paratype*). Oroya, Peru. Dorsal view. (× 1½.)

Fig. 5.—*Trimerotropis pallidipennis andeana* new subspecies. Female (*allotype*). Oroya, Peru. Dorsal view. (× 1½.)

Fig. 6.—*Trimerotropis ochraceipennis* (Blanch.). Female. Angol, Chile. Dorsal view. (× 1½.)



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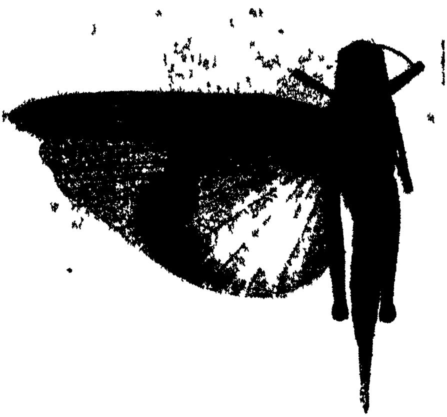

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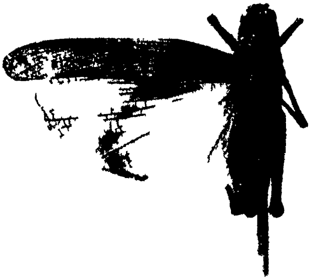

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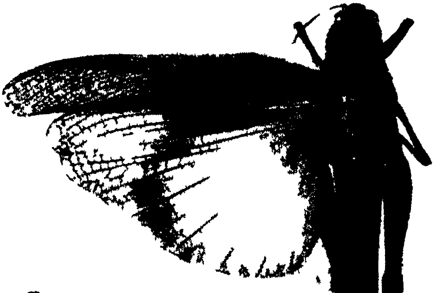

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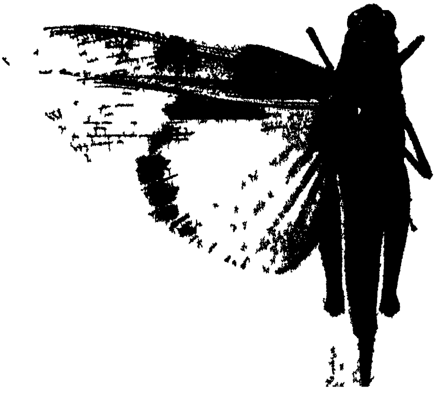

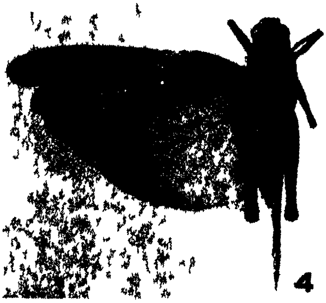

4

REHN—SOUTH AMERICAN TRIMEROTROPIS

STUDIES IN THE TIPHIIDAE

(HYMENOPTERA ACULEATA)

IV.[1] A Revision of the Myrmosinae of the New World with a Discussion of the Old World Species *

BY KARL V. KROMBEIN
Buffalo, New York

(Plate XXIV)

During the last several years I have had an opportunity to examine several hundred specimens of the comparatively uncommon Myrmosinae (in the sense of this paper). The majority of these have been Nearctic forms but I have had a sufficient number of the Palaearctic forms before me to justify publication of a revision of the Nearctic species together with a discussion of the Palaearctic species. A much greater amount of material and re-examination of the types will be necessary before the status of some of the Palaearctic species, particularly those belonging to the Thoracica Group, can be determined definitely and it is hoped that this paper may stimulate such research among our European confréres.

I wish to express my gratitude to Professor J. C. Bradley and Mr. V. S. L. Pate of the Department of Entomology, Cornell University for their encouragement and many helpful suggestions during the progress of this study. I am indebted to the officials of the Academy of Natural Sciences of Philadelphia and the United States National Museum at Washington for the privilege of examining types deposited in those institutions.

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[1] Pt. I, Ann. Ent. Soc. Amer., xxx, pp. 26-30, (1937).
Pt. II, Trans. Amer. Ent. Soc., LXIV, pp. 227-292, (1938).
Pt. III, Ann. Ent. Soc. Amer., xxxi, pp. 59-60, (1938).

* Presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirement for the degree of Doctor of Philosophy.

I acknowledge with gratitude the loans of specimens from the following institutions and individuals: the Academy of Natural Sciences [ANSP] through Mr. James A. G. Rehn; the United States National Museum [USNM] through Miss Grace Sandhouse; the American Museum of Natural History [AMNH] through Mr. Herbert F. Schwarz; Cornell University [CU] through Prof. J. C. Bradley; the Museum of Comparative Zoology [MCZ] through Mr. Nathan Banks; the Illinois Natural History Survey [INHS] through Dr. Herbert H. Ross; the University of Minnesota [UM] through Prof. C. E. Mickel; the Kansas State Agricultural College [KSAC] through Prof. R. H. Painter; the University of Kansas [KU] through Prof. H. B. Hungerford; the Texas Agricultural and Mechanical College through Prof. H. J. Reinhard; the North Carolina Department of Agriculture through Mr. C. S. Brimley [CSB]; Dr. Jos. Bequeart [Beq]; Dr. H. K. Townes [HKT]; Mr. H. I. Scudder [HIS]; the Boston Society of Natural History [BSNH] through Dr. Richard Dow; Ohio State University [OSU]; Citrus Experiment Station, Riverside, California through Dr. P. H. Timberlake [PHT]; British Museum (Natural History) [BM] through Mr. R. B. Benson; Naturhistorisches Staatsmuseum, Wien [Wien] through Dr. F. Maidl; Deutsches Entomologisches Institut [DEI] through Dr. Walther Horn; Dr. J. C. Bridwell [Brid]; Mr. George R. Ferguson [GRF]; Mr. Ezra Greenspan [EG]; Mr. James E. Gillaspy [JEG]; Dr. P. P. Babiy ([PPB]; Mr. F. W. Nunenmacher [FWN]; Dr. L. L. Peďhuman [LLP]; Dr. F. X. Williams [FXW]; Dr. K. Yasumatsu, Kyûshû Imperial University, Japan [KIU].

Dr. Raymond Roberts of the University of Nebraska [UN] has coöperated by sending data concerning the specimens in that collection.

MYRMOSINAE

The wasps comprising this subfamily have led rather a checkered existence so far as their taxonomic position is concerned. Most authors have placed them in the family Mutillidae on the sole basis of the wingless females of both groups. In my opinion the development of wingless females in these cases is merely an illustration of convergent evolution possibly due to their parasitic or " cuckoo " habits.

The Myrmosinae are separated from the Mutillidae by the following characters: the " felt " lines on certain of the abdominal segments which are lacking in both sexes of all Myrmosinae and present in all Mutillidae except both sexes of the Ethiopian *Rhopalomutilla* André and some of the females of the New World *Ephuta* Say and the Old World *Odontomutilla* Ashmead; the presence of a lamella at the base of the hind coxa above in both sexes; the presence of an anal lobe on the hind wing in the males which is lacking in all Mutillid males except the Old World Pseudophotopsidinae and Apterogyninae and the New World Chyphotinae; the fusion of the metapleura with the propodeum in the males; and the presence of a movable suture between the pronotum and the remainder of the thorax in the females.

Fox[2] in his classification of the North American Mutillidae divides them into the Mutillinae (the Mutillidae of contemporary classification) and the Thynninae on the basis of whether the thorax is undivided dorsally in the female or divided into two or more parts and whether the tip of the abdomen beneath in the male is supplied with two slender appendages or otherwise supplied. The character of the thoracic sclerotization is still used to separate Mutillid females from other wingless females. Among the females of his subfamily Thynninae, Fox includes a somewhat heterogeneous array of genera such as *Chyphotes* Blake which seems to be more allied to the true Mutillids on the basis of the " felt " lines on the second abdominal tergite rather than to some other family; *Brachycistis* Fox [= the females of the subgenus *Myrmosula* Bradley]; *Myrmosa* Latreille; *Morsyma* Fox which is a normal male Mutillid except for the lack of wings and not a female as stated by Fox; *Methoca* Latreille which I consider closely allied to the Myrmosinae but forming a distinct subfamily of the Tiphiidae; and *Glyptometopa* Ashmead, the generic position of which cannot be determined definitely until the males are known.

In the male Mutillids the two slender appendages at the tip of the abdomen which Fox uses to separate his two subfamilies are in reality only the tips of the squamae of the male genitalia and are not homologous with the hypopygium: consequently this character is no basis for separation. Among the males which he includes in the Thynninae are the true *Brachycistis* which form a separate subfamily of the Tiphiidae as I shall demonstrate subsequently, *Chyphotes, Methoca, Myrmosa* and *Telephoromyia* Ashmead [=*Fedtschenkia* Saussure] which is a Sapygid.

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[2] Fox, 1899, Trans. Amer. Ent. Soc., xxv, pp. 219-292.

Ashmead [3] establishes the family Myrmosidae including in it the subfamilies Bradynobaeninae, Myrmosinae and Apterogyninae. The first group is now placed in the Scoliidae and the last group belongs with the Mutillidae. He further subdivides the Myrmosinae into the Myrmosini including *Myrmosa* and *Ephutomma* Ashmead and the Chyphotini including *Brachycistis, Milluta* André, *Typhoctes* Ashmead, *Chyphotes* and *Magrettina* Ashmead. *Ephutomma* is a Mutillid as evidenced by the felt lines on the second tergite; *Magrettina* and *Milluta* are congeneric and belong in the Myzininae; [4] and as I have already pointed out *Typhoctes* and *Chyphotes* are more closely allied to the Mutillidae proper than to other groups and *Brachycistis* forms a subfamily of its own.

André [5] divides the Mutillidae into the Fedtschenkiinae, Methocinae, Myrmosinae, Apterogyninae and Mutillinae. *Myrmosa* is placed by itself in the Myrmosinae but the females of *Myrmosula* are placed in *Brachycistis* under the Methocinae.

Bradley [6] follows Ashmead's classification of the Myrmosidae "merely as a matter of convenience" and suggests that the females previously placed in *Brachycistis* are probably females of his new subgenus *Myrmosula*.

The Myrmosinae are separated from the Scoliidae by the nonstriolate apex of the forewing, the middle and posterior coxae which are contiguous and not overlaid by a continuous plate formed by the meso- and metasternum, and the upper surface of the hind coxae being armed with a lamelliform process basally.

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[3] Ashmead, 1903, Canad. Ent., xxxv, pp. 201-2.

[4] Krombein, 1937, Ann. Ent. Soc. Amer., xxx, p. 27.

[5] André, 1903, Genera Insect., Fam. Mutillidae, Fasc. 11, pp. 1-77.

[6] Bradley, 1917, Trans. Amer. Ent. Soc., xliii, pp. 247-290, pls. XX-XXV.

From other Tiphiidae the Myrmosinae differ only in the lack of an unciform hypopygium in the males. In the Myrmosinae this structure assumes a great variety of shapes as may be seen by examination of the accompanying figures and I do not think that much emphasis can be placed on its form as a subfamily character although it is of great value in the separation of subgenera and species within the subfamily. I consider that the family Tiphiidae may be separated conveniently into several subfamilies on the basis of the following table.

Key to the Subfamilies of the Tiphiidae

1. Winged 2
Wingless 6

2. Hind coxa armed with a lamella basally on the upper surface 3
Hind coxa without such a lamella 4

3. Hypopygium armed with a stout recurved aculeus; forewing with only two submarginal cells; anal lobe of hind wing large, extending two-thirds of the length of the submedian cell; cubital vein in hind wing arising before the transverse median vein ....*Methocinae*
Hypopygium not armed with a stout recurved aculeus; forewing with three submarginal cells; anal lobe of hind wing small, extending only about one-fifth of the length of the submedian cell; cubital vein in hind wing interstitial with the transverse median vein ...*Myrmosinae*

4. Antennae arising from beneath frontal ridges or tubercles; middle tibia with two spurs apically ....*Myzininae*
Antennae not arising from beneath frontal ridges or tubercles; middle tibia with only one spur apically 5

5. Tegula completely covering the axillary sclerites of the fore wing; tarsal claws cleft; an epicnemial furrow present on the mesopleura. *Tiphiinae*
Tegula not entirely covering the axillary sclerites of the fore wing; tarsal claws simple; mesopleura without an epicnemial furrow. *Brachycistidinae*

6. Antennae arising from beneath frontal ridges or tubercles 7
Antennae not arising from beneath frontal ridges or tubercles. *Methocinae*

7. Tarsal claws simple; only the pronotum separated from the rest of the thorax by a distinct suture; femora and tibiae more slender, not heavily armed with short thorns on the outer surface ....*Myrmosinae*
Tarsal claws cleft apically; pronotum, mesonotum, scutellum and propodeum separated by distinct sutures dorsally; femora and tibiae incrassate and heavily armed with short thorns on the outer surface. *Myzininae*

At present, only one genus, *Myrmosa* Latreille, may be allocated to this subfamily. Bridwell[7] states that *Myrmosula* Bradley should be accorded generic rank, but I have returned it to its original position as a subgenus of *Myrmosa*. The genera *Morsyma* Fox[8] and *Myrmosida* F. Smith[9] have been placed near *Myrmosa* by their respective authors. Dr. M. R. Smith of the United States National Museum informs me that the specimen of *Myrmosida* figured by F. Smith is a Ponerine ant. I have examined the type of *Morsyma Ashmeadii* Fox upon which the genus is based, in the United States National Museum, and find that it is a normal male Mutillid except for the lack of wings and not a female as stated by Fox.

Ethology.—Very little is known concerning the ethology of the wasps of this subfamily. They appear to be parasites or possibly commensals in the nests of other solitary wasps and bees. The little that is known concerning the ethology of certain of the species has been included in the discussion of those particular species. Apparently any one species of *Myrmosa* is not confined to one specific host but will prey upon several species of solitary wasps or bees.

MYRMOSA Latreille

Hylaeus (in part) Fabricius, Ent. Syst., II, p. 304, (1793).

Mutilla (in part) Fabricius, Ent. Syst., II, p. 372, (1793).—Coquebert, Illustr. icon. Ins., I, p. 26, (1801).—Jurine, Nouv. meth. class Hym, p 163, (1807).—Olivier, Encycl. meth., VIII, p. 65, (1811)—Lamarck, Hist. nat. anim. sans vert, IV, p. 100, (1817)—Blanchard, Hist. nat. Ins, p 376, (1840).—Black, Trans. Amer. Ent. Soc., VII, p. 248, (1879).—Cresson, Trans. Amer. Ent. Soc., XIV, Suppl., p. 264, (1887)—Dalla Torre, Cat. Hym., VIII, p. 5, (1897)—Ed Saunders, Ent. Month. Mag., 1899, p. 228, (1899).

Myrmosa Latreille, Prec. Car. gen. Ins, p. 118, (1796).—Panzer, Faun. Ins. German., Heft. 85, pl. 14, (1801).—Jurine, Nouv. meth. class Hym., p. 163, (1807).—Olivier, Encycl. meth. Ins, VIII, p. 128, (1811).—Say, Narr. Exp. St. Peter's River, II, p. 331, (1824).—Shuckard, Essay Indig. Foss. Hym., p. 33, (1837).—Lepeletier, Hist. nat. Ins. Hym., III. p. 589, (1845).—Costa, Fauna Nap. Mutill., p. 4, (1858).—F. Smith, Cat. Brit. Foss. Hym., p. 42, (1858).—Blake, Trans. Amer. Ent. Soc., VII, p. 254, (1879).—Fox, Trans. Amer. Ent. Soc., XXV, p. 285, (1899).—André, Spec.

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[7] Bridwell, 1920, Proc. Hawaiian Ent. Soc., IV, p. 392.

[8] Fox, 1899, Trans. Amer. Ent. Soc., XXV, p. 287.

[9] F. Smith, 1857, Proc. Linn. Soc., Zool., II, p. 83, pl. II, fig. 1.

Hym. d'Eur. et d'Alg., VIII, p. 102, (1900).—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 11, (1903).—Ashmead, Canad. Ent., XXXV, pp. 201-2, (1903).—Bradley, Trans. Amer. Ent. Soc., XLIII, p. 248, (1917).—Bischoff, Arch. f. Naturg, LXXXVI, Abt. A, Heft. 1, p. 50, (1920).—Bridwell, Proc. Hawaiian Ent. Soc, IV, p. 393, (1920).

Ischioceras (in part), Provancher, Natural. Canad., XIII, p. 8, (1882); [♀ *nec* ♂].

Brachycistis (in part), Fox, Trans. Amer. Ent. Soc., XXV, p. 285, (1899); [♀ *nec* ♂].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 9, (1903).—Bradley, Trans. Amer. Ent. Soc., XLIII, p. 280, (1917); [♀ *nec* ♂].

GENOTYPE: *Myrmosa atra* Panzer, 1801 [=*Mutilla melanocephala Fabricius,* 1793 = *Myrmosa melanocephala* (Fabricius) =*Myrmosa* (*Myrmosa*) *melanocephala* (Fabricius)]. (Genus originally described with no included species. In 1801, Panzer included *M. atra* Panzer only, which thereby was automatically fixed as the genotype.)

Generic Characters.—Male. Head rounded, transverse; antennae filiform, rather short, 13-segmented, the insertions overhung above by small frontal lobes; compound eyes finely pubescent, the inner margins divergent above and slightly sinuate; three ocelli present. Thorax with the scutellum prominent; pronotum rather broadly truncate anteriorly, not much narrower there than at its greatest width; mesopleura moderately inflated; tegula small and scale-like; mesonotum with two pairs of longitudinal impressed lines, the outer pair not very well developed; metapleura fused with lateral surface of propodeum. Legs slender, spineless or with very weak ones on the hind tibia and the tarsi beneath; coxae contiguous; tibial spurs 1–2–2; tarsal claws with a tooth near the apex; hind coxae armed with a lamelliform process above near the base. Wings present, the fore wing with three submarginal cells, the second receiving the first recurrent nervure and the third receiving the second recurrent nervure; hind wing with the transverse median and cubital cross veins interstitial, the median vein not continued beyond the apex of the submedian cell; anal lobe small, extending only about one-fifth the length of the submedian cell. Abdomen 7-segmented, fusiform, somewhat depressed, the constrictions between the segments usually well-marked; second abdominal sternite with a small oval shagreened stridulatory (?) area at the antero-lateral corner; segments apically with a narrow flattened impunctate margin; pygidial area not defined.

Female. Head varied in shape and position; antennae 12-segmented, filiform, the insertions overhung above by small frontal lobes. Prothorax separated from the rest of the thorax by a suture permitting independent movement; mesopleura very slightly inflated. Legs slender, weakly spined; hind coxa armed with a sharp lamelliform process above at the base; coxae

contiguous; tibial spurs 1-2-2; tarsal claws simple. Wingless. Abdomen 6-segmented, elongate-ovate with a truncate base to sub-fusiform, not noticeably depressed; a deep constriction between the first and second sternites, the remaining segments imbricate; first sternite with a keel or hook; pygidial area not defined.

Species Groups.—The species of the genus *Myrmosa* Latreille fall into several discrete groups as listed below:

Myrmosina new subgenus

- *texana* new species
- *nocturna nocturna* new subspecies
- *nocturna rufigastra* new subspecies

Subgenus *Myrmosa* Latreille

Melanocephala Group

- *peculiaris* new species
- *blakei* Bradley
- *bradleyi* Roberts
- *unicolor* Say
- *melanocephala melanocephala* (Fabricius)
- *melanocephala nigrofasciata* Yasumatsu
- *minuta* Morawitz

Thoracica Group

- *thoracica* (Fabricius)
- *nigriceps* S. S. Saunders
- *tangerina* Mercet
- *longicollis longicollis* Tournier
- *longicollis* var. *tenietensis* André
- *frater* (Ed. Saunders)
- *brunnipes* Lepeletier

Subgenus *Myrmosula* Bradley

- *parvula* Fox
- *rufiventris* Blake
- *exaggerata* new species
- *rutilans* (Blake)

Only the males of the subgenus *Myrmosina* are known and they may be separated by the following characters: the length of the hypopygium which is much longer than the genitalia; the slender hypopygial processes; the channel on the ental surface of the squamae of the genitalia; the presence of a clypeal carina; the presence of a basal process on the first sternite only; and the apical emargination of the seventh abdominal sternite. The members of this subgenus are confined to the Great Plains subregion of the Nearctic region in distribution and have probably arisen from the *unicolor—peculiaris* sequence of the Melanocephala Group.

Table 1. Comparison of characters of species groups of Myrmosinae

MALES	Length of hypopygium	Hypopygial processes	Channel on squamae of genitalia	Clypeal carina	Process at base of sternite I	Process at base of sternite II	Apical margin of sternite VII
Myrmosina	longer than genitalia	slender	present	present	present	absent	emarginate
Melanocephala Group	longer than genitalia	slender	absent	present	present	present	rounded
Thoracica Group	subequal to genitalia	expanded	absent	present	present	present	emarginate
Myrmosula	subequal to genitalia	absent	absent	absent	absent	absent	emarginate

FEMALES	Form of body	Shape of head behind eyes	Basal lamella on mandibles	Clypeal spine	Ocelli	Keel on sternite I
Myrmosina	?	?	?	?	?	?
Melanocephala Group	slender	usually narrowed	absent	present	usually present	present
Thoracica Group	stout	quadrate	absent	present	present	present
Myrmosula	stout	quadrate	present	absent	absent	absent

The males of the Melanocephala Group are distinguished by the following characters: the length of the hypopygium which is much longer than the genitalia; the slender hypopygial processes; the lack of a dorso-ventral channel on the ental surface of the squamae of the genitalia; the presence of a clypeal carina; the presence of basal processes on the first and second abdominal sternites; and the rounded apical margin of the seventh sternite. The females of the Melanocephala Group are distinguished by the following characters: the slender form of the body; the head which is usually narrowed behind the eyes; the absence of a lamella on the basal inferior edge of the mandibles; the presence of a clypeal spine; the presence of ocelli; and the presence of a keel at the base of the first abdominal sternite. The females of *peculiaris, blakei* and *bradleyi* have a quadrate head when viewed from above as do those of the Thoracica Group but the former are entirely ferruginous and have slender bodies. *Bradleyi* is the only species of these three in which both sexes are known; the male of this species is so closely related to the male of *unicolor* that it is not feasible to erect a separate group for the reception of these species having a quadrate head in the female sex. The female of *minuta* is stated to lack ocelli but re-examination of the type is needed to verify this point. *Peculiaris* is known from Kansas only, *blakei* from New York only and *bradleyi* from the coastal region of the western United States. *Unicolor* is widely distributed over the United States while its Palaearctic counterpart *melanocephala* has an equally wide distribution, extending across Europe and Siberia with the subspecies *nigrofasciata* occurring in Japan. *Minuta* is known from Turkmenistan only.

The males of the Thoracica Group are distinguished by the following characters: the length of the hypopygium subequal to that of the genitalia; the hypopygial processes considerably expanded; the absence of a dorso-ventral channel on the ental surface of the squamae of the genitalia; the presence of a clypeal carina; the presence of basal processes on the first and second abdominal sternites; and the emarginate apical margin of the seventh abdominal sternite. The females of the Thoracica Group are distinguished by the following characters: the comparatively stout body; the quadrate head; the absence of a lamella on the basal inferior edge of the mandibles; the presence of a clypeal spine; the presence of ocelli; and the presence of a keel on the first abdominal sternite. The male of *brunnipes* lacks a process at the base of the second abdominal sternite, but the other characters are the same as other species of the group. The species of the Thoracica Group are confined to the Eremian or Mediterranean subregion of the Palaearctic region with the exception of *brunnipes* which extends northward to Poland and eastward into Manchoukuo.

The males of the subgenus *Myrmosula* are distinguished by the following characters: the length of the hypopygium subequal to that of the genitalia; the hypopygial processes absent, the entire sclerite being a simple trapezoidal piece; the lack of a dorso-ventral channel on the ental surface of the squamae of the genitalia; the absence of a clypeal carina; the absence of processes at the bases of the first and second abdominal sternites; and the broadly emarginate apical margin of the seventh abdominal sternite. The females of the subgenus *Myrmosula* are distinguished by the following characters: the comparatively stout body; the quadrate head; the presence of a lamella on the basal inferior edge of the mandibles; the absence of a clypeal spine; the absence of ocelli; and the absence of a keel on the first abdominal sternite. The members of this subgenus are confined to the Nearctic region; *parvula* is probably widely distributed over the United States east of the 100th meridian while the other species have very limited distributions in the far western United States.

This linear arrangement of species is rather unsatisfactory since it obscures, to some extent, the probable phylogenetic sequence. In all probability the Melanocephala and Thoracica Groups have had a parallel development, the former culminating in the subgenus *Myrmosina* through the *unicolor—peculiaris* sequence while the latter has given rise to the subgenus *Myrmosula* through some such form as *brunnipes*.

While at first glance it may seem rather strange to derive *Myrmosula,* which is Nearctic in distribution, from the Thoracica Group which is confined mainly to the Eremian subregion of the Palaearctic, I think an examination of the characters set forth in the preceding table will effectually demonstrate the morphological similarities of the two groups. *Brunnipes* of the Thoracica Group gives us some clue as to what might have been the probable ancestral stock of *Myrmosula.* In the male the second abdominal sternite lacks the basal process, the genitalia show strong affinities to *parvula* (see Figures 5 and 11) and the last abdominal tergite is evenly convex when viewed from the side as in *Myrmosula* rather than abruptly declivous as in most other males of the Thoracica Group. The distribution of *brunnipes* also makes such a derivation for *Myrmosula* a little more probable.

Subgenera.—The genus *Myrmosa* Latreille may be divided conveniently into three subgenera on the basis of the characters presented in the key below.

Key to the Subgenera of Myrmosa

1. Winged; males 2
   Wingless; females 4
2. First and second abdominal sternites armed with a median process near the base of each segment (except in *brunnipes* Lep. which has a simple second sternite); clypeus armed with a median longitudinal carina or keel at the base ....*Myrmosa* Latreille
   Second abdominal sternite simple 3
3. First abdominal sternite with a hook-like median process near the base; last abdominal tergite usually abruptly declivous near the base with a median longitudinal fossa on the declivous portion; clypeus with a median longitudinal carina at the base .....*Myrmosina* new subgenus
   First abdominal sternite simple; last abdominal tergite not abruptly declivous, without a median longitudinal fossa; clypeus convex, without a carina ....*Myrmosula* Bradley
4. Mandibles without a lamelliform process on the inferior edge basally; body coarsely punctured and sculptured; ocelli usually present, clypeus with a median spine at the base ....*Myrmosa* Latreille
   Mandibles with a lamelliform process on the inferior edge basally; body finely punctured; ocelli lacking; clypeus without a median spine at the base ....*Myrmosula* Bradley

Subgenus **MYRMOSA** Latreille

Myrmosa Latreille, Prec. Car. gen. Ins., p. 118, (1796).

Ischioceras (in part) Provancher, Natural. Canad., XIII, p. 8, (1882); [♀ *nec* ♂].

Myrmosa (*Myrmosa*) Bradley, Trans. Amer. Ent. Soc., XLIII, p. 248, (1917).

GENOTYPE: *Myrmosa atra* Panzer, 1801 [=*Mutilla melanocephala* Fabricius, 1793 = *Myrmosa* (*Myrmosa*) *melanocephala* (Fabricius)].

Since the nomenclatorial history of this group is essentially the same as that of the genus, only the pertinent references have been repeated.

Subgeneric characters.—In addition to the characters given in the generic characterization, the subgenus *Myrmosa* presents the following characters. Male. Clypeus with a short median longitudinal keel at base; mandibles stout, tri- or quadri-dentate apically; second submarginal cell of fore wing usually triangular; last abdominal tergite usually abruptly declivous posteriorly; first and usually the second abdominal sternites armed with a median hook-like process or tubercle near the base; hypopygium composed of a median process which varies from spear-shaped to rectangular to orbicular and a pair of lateral processes varying from slender to suborbicular each of which may have a smaller process arising from the base. Female. Clypeus with a median spine basally; three ocelli usually present; mandibles without a lamelliform process on the inferior edge near the base; body coarsely punctured and sculptured.

Distribution.—The subgenus *Myrmosa* is primarily Holarctic in distribution. One species has been described from Java by Olivier but examination of the type will probably prove it referable to some other genus or that the specimen has been mislabeled and is identical with one of the species considered here.

Component Species.—As understood here, the subgenus *Myrmosa* comprises thirteen species, one subspecies, one variety and possibly several of those listed at the end of the paper under species of uncertain position.

These species may be separated by the following key.

Key to the Species of the Subgenus Myrmosa

1. Wingless; females 2
   Winged; males 15
2. First abdominal tergite with a broad ivory-colored band across the apical margin; head not narrowed behind the eyes; Palaearctic forms 3
   First abdominal tergite without an ivory-colored band across the apical margin 5
3. Antennae and thorax except prothorax, black ......*Spinolae* Lepeletier
   Antennae and thorax ferruginous 4
4. Anterior angles of prothorax produced and slightly dentiform; head and thorax coarsely and closely punctato-reticulate and dull. *longicollis* Tournier
   Anterior angles of prothorax not dentiform; head less closely punctured and shining ....*thoracica* (Fabricius)
5. Head not narrowed behind the eyes 6
   Head conspicuously narrowed behind the eyes 12

6. Head and thorax ferruginous; Nearctic forms 7
   Head black and thorax ferruginous; Palaearctic forms 9
7. Antennal scrobes bounded by a distinct carina extending laterad to the inner margins of the compound eyes; posterior face of propodeum very low, much broader than high, the upper portion bounded by a circlet of very broad erect teeth ....*peculiaris* new species
   Antennal scrobes not bounded by such a carina; posterior surface of propodeum higher, the circlet composed of smaller, narrower teeth..8
8. Anterior and posterior angles of thorax prominent and armed with a sharp tooth; pronotal disk narrower, more transverse.
   blakei Bradley
   Anterior angles of thorax not prominent, rounded; posterior angles armed with a much weaker tooth; pronotal disk longer, almost as long as broad ....*bradleyi* Roberts
9. Third segment of antennal flagellum broader than long, somewhat angled at the middle; dorsal portion of first abdominal tergite and basal half of second tergite ferruginous 10
   Third segment of antennal flagellum longer than broad, not angled at the middle; abdomen entirely black 11
10. Anterior thoracic angles produced and slightly dentiform; abdominal tergites with suberect dark bristles; size smaller, 5 to 9 mm. long.
    brunnipes Lepeletier
    Anterior thoracic angles not produced; abdominal tergites without suberect dark bristles; size larger, 12 mm. long.
    nigriceps S. S. Saunders
11. Anterior angles of thoracic dorsum prominent and dentate; ocelli distinct ....*longicollis* var. *tenietensis* André
    Anterior angles of thoracic dorsum not prominent, rounded; ocelli indistinct ....*tangerina* Mercet
12. Second abdominal sternite with a median tubercle or cariniform process near the base; head usually black varying to piceous; Palaearctic forms 13
    Second abdominal sternite without such a process; head usually ferruginous varying to piceous; Nearctic forms ....*unicolor* Say
13. Ocelli lacking; head finely and sparsely punctured; smaller forms, 3 mm. in length ....*minuta* Morawitz
    Ocelli present; head more closely punctured; larger forms, 3 to 8 mm. in length 14
14. Puncturation of body sparser and finer; clypeus and mesonotum ferruginous; forms from Europe and Asia.
    melanocephala melanocephala (Fabricius)
    Puncturation of body closer and coarser; clypeus and mesonotum black; Japanese forms ......*melanocephala nigrofasciata* Yasumatsu

15. Seventh abdominal sternite with a pronounced median longitudinal carina on the apical portion, the apical margin of the segment rounded and not emarginate; seventh tergite abruptly declivous, with a longitudinal fossa on the depressed portion and bilobate apically 16

Seventh abdominal sternite without such a carina on the apical portion 17

16. Pubescence lighter, varying to cinereous; clypeal puncturation closer; forms from Europe and Asia.
melanocephala melanocephala (Fabricius)

Pubescence darker, varying to black; clypeal puncturation sparser; forms from Japan ....*melanocephala nigrofasciata* Yasumatsu

17. Apical margin of the seventh abdominal sternite emarginate medianly; hypopygium as long as genitalia; Palaearctic forms 18

Apical margin of the seventh sternite rounded, not emarginate medianly; hypopygium longer than the genitalia; Nearctic forms ..23

18. Second abdominal sternite without a median tubercle near the base; median lobe of hypopygium (the eighth sternite) greatly expanded laterally; thorax always black; fore wings subhyaline, without a preapical infumation ....*brunnipes* Lepeletier

Second abdominal sternite armed with a median tubercle or process near the base; median lobe of hypopygium not greatly expanded laterally; antero-dorsal portion of thorax usually ferruginous; fore wings entirely infumated or at least with a preapical nebulosity ...19

19. Lateral margin of seventh abdominal tergite not dentate near the base, at most sinuate; lateral process of hypopygium without a slender shorter process lying between it and the median process.
frater (Ed. Saunders)

Lateral margin of the seventh tergite dentate near the base; lateral process of hypopygium with a slender shorter process lying between it and the median process 20

20. Apices of abdominal tergites one to five with a long thick fringe of white hairs; segments two to six not contracted or strangulated apically; wings entirely infumated ....*nigriceps* S. S. Saunders

Apices of abdominal tergites one to five sparsely haired; segments two to six contracted or strangulated apically; wings only partially infumated 21

21. Pubescence of head, thorax and abdomen black . ....*tangerina* Mercet

Pubescence of head, thorax and abdomen white or greyish 22

22. Anterior angles of pronotal disk prominent and dentate; tegulae black, closely punctured and subfulgid ....*longicollis* Tournier

Anterior angles of pronotal disk prominent, but not dentate; tegulae ferruginous, sparsely punctured and shining ....*thoracica* (Fabricius)

23. Pubescence of head black; clypeus without a median tubercle near the base; first abdominal sternite without a pit near each latero-apical corner; wings infumated .... *bradleyi* Roberts
 Pubescence of head white; clypeus usually with a median keel near the base; first abdominal sternite usually with a pit near each latero-apical corner; wings subhyaline .... *unicolor* Say

NEARCTIC SPECIES

Myrmosa (Myrmosa) unicolor Say (Pl. XXIV, fig. 6.)

Myrmosa unicolor Say, Narr. Exp. St. Peter's Riv., II, p. 331, (1824); [♂].—Blake, Trans. Amer. Ent. Soc., XIII, p. 278, (1886); [♂].—Provancher, Addit. Faun. Canad., Hym., p. 252, (1887); [♂].—Cresson, Trans. Amer. Ent. Soc., XIV, Suppl., p. 267, (1887).—Fox, Journ. N. Y. Ent. Soc., p. 53, (1893); [♂].—Fox, Trans. Amer. Ent. Soc., XXV, p. 286, (1899); [♂].—Melander & Brues, Biol. Bull., V, p. 7, (1903); [♀ ♂].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 13, (1903).—Viereck (in Smith), Ann. Rept. New Jersey State Mus. 1909, p. 665, (1911).—Rohwer, Conn. Geol. & Nat. Hist. Surv., Bull. 22, p. 621, (1916); [♀ ♂].—Bridwell, Proc. Hawaiian Ent. Soc., IV, p. 393, (1920).—Bradley (in Leonard), Cornell Univ. Agr. Exp. Sta., Mem. 101, p. 993, (1928).—Brimley, Ins. of North Carolina, N. Car. Dept. Agr., p. 437, (1938).

Ischioceras rugosa Provancher, Natural. Canad., XIII, p. 8, (1882); [♀ *nec* ♂].—Provancher, Faun. entom. Canad., Hym., p. 252, (1883).

Mutilla thoracica Blake (*nec* Smith), Trans. Amer. Ent. Soc., XIII, p. 204, (1886); [♀].—Cresson, Trans. Amer. Ent. Soc, XIV, Suppl., p. 264, (1887).

Mutilla erythronota Dalla Torre, Cat. Hym., VIII, p. 36, (1897); [*nom. nov.* for *Mutilla thoracica* Blake *nec* Smith].

Mutilla unicolor Dalla Torre, Cat. Hym., VIII, p. 94, (1897).

Myrmosa thoracica Fox, Trans. Amer. Ent. Soc., XXV, p. 287, (1899); [♀].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 13, (1903).

Myrmosa (Myrmosa) unicolor Bradley, Trans. Amer. Ent. Soc., XLIII, pp. 249-250, pl. 20, fig. 2, (1917); [♀ ♂].

Myrmosa (Myrmosa) banksi Bradley, Trans. Amer. Ent. Soc., XLIII, pp. 250-251, (1917); [♀]. (New Synonymy.)

Myrmosa dakotensis Weber, Psyche, XLI, p. 57, (1934); [♀]. (New Synonymy.)

The females are distinguished from other Nearctic *Myrmosa* by the shape of the head which is narrowed behind the eyes. From the closely related Palaearctic *melanocephala* (Fabricius) it is separated by the lack of a low median glabrous tubercle or cariniform process near the base of the second abdominal sternite. The male is separated from the Nearctic *bradleyi* Roberts by the whitish pubescence and the hyaline wings and from *melanocephala* by the unmodified seventh abdominal sternite.

I have a rather extensive series of this species before me and it is quite apparent that there is a great deal of variation in the degree and intensity of the puncturation and sculpture. For these reasons I have placed *banksi* and *dakotensis* in the synonymy. In a series of over one hundred females from Ithaca, New York there is a gradual range in length from 3 to 6.5 mm. Closely correlated with this increase in length is a gradual increase in coarseness of the thoracic sculpture, density of puncturation of the head and abdomen particularly the second tergite and size of the propodeal circlet of teeth, ranging from the smallest form which is much more sparsely punctured than typical *banksi* to a form which is more densely punctate than any Bradley had before him in his series of *unicolor*. In the males the story is the same—a gradual increase in length correlated with increased coarseness of head and thoracic sculpture and density of abdominal puncturation. In addition, the larger specimens have a pair of pits near the postero-lateral angles of the first abdominal sternite; in the largest specimens these pits are quite deep and wide; with a decrease in length there is a gradual decrease in depth and extent of the pits until they become mere dimpled impressions in smaller specimens and are totally lacking in the smallest ones. Moreover, I am unable to find any differences, other than size, in the genitalia of large and small males. These variations are undoubtedly due to a difference in availability of larval food, probably correlated with a difference in size of the host species, since it is extremely unlikely that any one species of *Myrmosa* is confined to one specific host only.

Type.—♂; Northwest Territory. (Say).*

Male. 4.5 to 13 mm. long. Black; mandibles near apices and tegulae at apices, occasionally ferruginous; legs and antennae, and body (very rarely), occasionally piceous. Body rather closely covered with short erect to suberect whitish pubescence particularly noticeable at the apices of the abdominal segments. Wings subhyaline; stigma and basal nervures black to piceous; apical nervures piceous to testaceous.

Head subfulgid, closely and moderately deeply punctato-reticulate to sparsely and shallowly pitted; clypeus with the disk flat, varying from closely punctate to almost impunctate, the basal median longitudinal keel well-developed and extending one fourth to one third the distance to the apex; antennae short, rather stout, the antennal scrobes separated; ocelli normal, the postocellar distance varying from 1.4 to 1.8 times the lateral ocellar distance, the ocellocular distance varying from 2.7 to 4.2 times the lateral ocellar distance.

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* No longer in existence.

Thorax subopaque, the prothoracic angles prominent but not dentate; pronotum, mesonotum, scutellum and mesopleura slightly more coarsely sculptured than the head and varying likewise; scutellum with a shallow median longitudinal channel; postscutellum and dorsum of propodeum finely and closely punctato-reticulate, the latter with a median longitudinal channel basally; propleura moderately punctato-rugulose; lateral surface of propodeum variable, usually impunctate anteriorly and punctate posteriorly.

Abdomen subfulgid; base of first tergite minutely and closely punctate; apex of first tergite and remaining tergites with moderately large well-separated punctures, the apices glabrous and impunctate; last tergite more closely punctate, the lateral margin sinuate, the apical margin bilobate, abruptly declivous near the base, the declivous portion with a longitudinal median fossa or concavity; first sternite very finely punctate, a pair of pits near the postero-lateral corners occasionally; sternites two to six more finely and closely punctate than the tergites, particularly medianly, the apices narrowly impunctate; seventh sternite with minute well-separated punctures and without a median longitudinal keel apically, the apical margin rounded, not emarginate.

Female. 3 to 8 mm. long. Ferruginous; apices of mandibles, spot on front between eyes occasionally, band on mesopleura occasionally, broad median band on second tergite, basal half of third tergite, fourth to sixth tergites entirely, and legs occasionally, black to castaneous; the extent of the darker markings varies considerably—in some specimens the mesopleural band is carried across the mesonotum, the ferruginous areas on the second and third tergites may be considerably reduced and some of the sternites may occasionally have darker bands; in a few specimens the normal ferruginous areas are castaneous, only the antennae and clypeus remaining ferruginous. Front, vertex, and dorsum of thorax and abdomen with short black subappressed bristles, the pleural and sternal regions and apices of abdominal segments with subappressed silvery pubescence.

Head subopaque to fulgid, the front and vertex sparsely to densely and moderately coarsely punctured, narrowed behind the eyes; ocelli distinct, the post-ocellar distances varying from 1.1 to 1.6 times the lateral ocellar distance and the ocellocular distance varying from 1.8 to 3.0 times the lateral ocellar distance.

Thorax subfulgid to fulgid, the anterior angles prominent but not dentate; width of pronotal disk at anterior angles varying from 1.8 to 2.5 times the median length of the disk, the median length of the remainder of the thorax varying from 1.6 to 2.4 times the median length of the pronotal disk; sculpture of dorsum varying from quite coarsely and closely punctato-reticulate to very shallowly and sparsely so; posterior angles of dorsum not prominent, the circlet of teeth occasionally greatly reduced but usually composed of from six to twelve rather short flattened teeth; propleura moderately punctured to impunctate anteriorly and above and longitudinally rugulose below and posteriorly; mesopleura varying from moderately closely and finely punctate to nearly impunctate; lateral surface of propodeum usually minutely and rather closely punctate at least below and posteriorly.

Abdomen fulgid, first tergite with one or two noticeable transverse carinae at the base of the dorsal disk, the declivous anterior portion minutely and usually rather closely punctate, the dorsal portion transversely rugulose except the apical border which is minutely and closely punctate; second to sixth tergites varying from very closely punctate to very sparsely so; second tergite with well-separated larger punctures and without a median glabrous tubercle or cariniform process near the base; the remaining sternites more minutely and closely punctate along the apical border.

Distribution.—This species is very widely distributed in the United States occasionally penetrating into Canada.

Specimens examined: 500; 238 females, 262 males.

Canada: 3♂, Toronto, (R. J. Crew), [USNM]. 1♂, Coniston, Ontario, July 27, 1915, (H. S. Parish); 1♂, Joliette, July 14, 1902; [both CU]. 1♂, no other data, [ANSP]. 1♀, Victoria, British Columbia, Aug. 11, (Darlington), [AMNH].

Maine: 1♂, Mount Desert, Aug. 11, [BSNH].

Vermont: 1♀, 1♂, Rutland, Aug. 1-15, 1916, (Chittenden), [Beq]. 2♂, Norwich, July 7, 1908, [BSNH].

Massachusetts: 1♀, 1♂, Stony Brook Reservation, July 12, 1925; 1♀, Brookline, Sept. 6, (C. W. Johnson); 1♂, Chester, Aug. 9, 1922, (Owen Bryant); 1♂, Fall River, July 11, 1916, (J. A. Cushman); 1♂, Martha's Vineyard, Aug. 12, (F. M. Jones); 1♂, Horseneck Beach, Westport, July 29, 1930, (R. Dow); 2♂, Auburndale, Aug. 11, (C. W. Johnson); [all BSNH]. 1♀, 1♂, Farm Street, Dover, July 9, 1925, [Beq, BSNH]. 1♂, [ANSP].

Rhode Island: 6♂, Westerly, June 8–Aug. 15, 1936; 1♂, Charlestown, June 27, 1937; (both M. Chapman), [all HKT].

Connecticut: 2♂, Canterbury, July 25, 1937, (M. Chapman), [HKT].

New York: 1♂, Babylon, L. I., July 7, 1936, (Blanton & Borders), [GRF]. 3♂, Gardiner's Island, Aug. 17-23, 1918, [Beq]. 5♀, Farmingdale, L. I., Aug. 6-21, 1938, (H. & M. Townes), [HKT]. 2♀, 1♂, Farmingville, L. I., July 1–Sept. 12, 1937, (K. V. Krombein; male on scrub pine); 1♂, Bohemia, L. I., June 20, 1937, (K. V. Krombein); [both KVK]. 1♀, 5♂, Lott Wood, Flatbush, L. I., July 10–Sept. 5, (J. L. Zabriskie), [AMNH]. 1♂, Flatbush, L. I., July 2, 1895, (J. L. Zabriskie), [INHS]. 1♂, Water Works, Flatbush, L. I., July 10, 1893, (J. L. Zabriskie), 1♂, Parkville, L. I.; 1♂, Cold Spring Harbor, L. I., July 30, 1900; [all AMNH]. 2♀, 1♂, Yonkers, July 1-26, (L. L. Pechuman), [KVK, LLP]. 1♂, West Farms, N.Y.C., (J. Angus), [AMNH]. 1♂, Armonk, July 13, 1937, (L. L. Pechuman), [KVK]. 1♂, Rhinebeck, July 27, 1907, (C. R. Crosby), [CU]. 1♂, Storm King, Aug. 5, 1917, (Schott); 1♂, White Plains, June 29, 1918, (Jos. Bequaert); [both Beq]. 1♀, Elka Park, Aug. 13-18, 1917, [MCZ]. 1♀, Westchester Co., Aug. 27, 1936; 5♂, Poughkeepsie, July 30–Aug. 20, 1936; 1♂, Shokan, July 11, 1936; 1♂, Lake Mohonk, Ulster Co., Aug. 1, 1936; (all H. K. Townes), [all HKT]. 1♂, Boreas River, Essex Co., July 6-8, 1939, (J. G. Franclemont; at light trap), [KVK]. 2♀, Minetto, Oswego Co., July 25, 1936; 1♀, Granby sand dunes, Oswego Co., Sept. 1, 1936; (both K. V. Krombein), [both KVK]. 1♂, Lake George, July 10, 1907, (J. L. Zabriskie); 1♂, Cranberry Lake, July 11, 1917, (C. J. Drake); [both AMNH]. 2♂, Spring Lake, Cayuga Co., July 21-22, 1918, [Wien]. 1♀, Taughanic Falls, Aug. 21, 1925, [CU]. 152♀, 97♂, Ithaca, June 15–Oct. 10, (P. P. Babiy, H. I. Scudder, J. G. Franclemont, K. V. Krombein—1♂ on *Daucus carota,* H. Rahn, E. Greenspan, E. H. Sargent), [PPB, CU, HIS, KVK, EG]. 6♂, Breesport, July 5-25, 1937, (H. I. Scudder; on honeydew of *Myzus ribis* on currant), [HIS]. 1♂, Rochester Junction, June 29, 1914, (M. D. Leonard), [CU]. 1♂, Middleport, Aug. 8, 1939, (K. V. Krombein; on *Daucus carota*); 1♂, Jamestown, July 23, 1934; (C. Tongyai); [both KVK]. 5♂, Bemus Point, July 15-31, 1937, (H. K. Townes), [HKT]. 1♂, Buffalo, June 29, 1934, (K. V. Krombein), [KVK].

New Jersey: 1♀, Camden Co., Sept. 29, 1889, [BM]. 4♀, 10♂, North Woodbury, June 13-22, 1901; 1♂, Riverton, July 7, 1901; 1♀, 1♂, Westville, June 13, 1901, (H. L Viereck); [all ANSP]. 1♂, Alpine, June 19, 1918, [Beq].

Pennsylvania: 2♀, Bryn Mawr, Sept. 15, 1909, [BM]. 2♂, Philadelphia, Aug., (Carl Ilg), [CU, ANSP]. 2♂, Lehigh Gap, July 11, (J. C. Bradley), [CU, ANSP]. 1♂, Roxboro, July 16, (F. Haimbach); 2♀, St. Vinc[ent]; [both ANSP].

Maryland: 1♂, Hagerstown, June 19, 1934, [KVK]. 2♂, Cabin John, June 15-21, 1917, (R. M. Fouts); 1♀, Chesapeake Beach, July 27, 1913, (R. C. Shannon); [both USNM]. 1♀, 2♂, Plummer's Island, July 3-28, (Schwarz & Barber), [Beq, USNM].

District of Columbia: 2♂, Rock Creek Pkwy., Washington, July 8, 1934, (J. C. Bridwell), [Brid].

Virginia: 3♂, no other data, [ANSP]. 1♀, no other data, (T. Pergande); 3♀, Barcroft, Sept. 11-18, (J. C. Bridwell); 1♀, 1♂, Chain Bridge, July 24–Aug. 7, 1913, (H. B. Kirk, G. M. Greene); 2♂, East Falls Church, July 17, 1912, (Wm. Middleton); 2♂, Rosslyn, (H. H. Smith); [all USNM]. 2♀, Vienna, July 4, 1935, (K. V. Krombein), [KVK]. 11♀, 1♂, Clifton, July 1–Aug. 27, (J. C. Bridwell), [USNM, Brid]. 1♀, Penington Gap, [MCZ]. 8♀, 1♂, Falls Church, July 28–Sept. 3, (N. Banks; one taken on tulip tree honey dew), [CU, MCZ; 5♀ paratypes of *banksi*]. 5♂, Falls Church, June 10–July 21, (Wm. Middleton), [Brid].

North Carolina: 1♀, Swannanoa Valley, Aug. 4, 1906; 3♂, Valley of Black Mts., July 18-23, 1906, (W. Beutenmuller); [both AMNH]. 1♂, Winston-Salem, Aug. 8, 1934, (D. L. Wray); 2♂, Raleigh, June 8-20, (C. S. Brimley); [both CSB].

OHIO: 1♀, Lake Laramie, Sept. 8-9, 1934, (J. C. Hambleton), [OSU]. 1♀, West Jefferson, Franklin Co., [Beq]. 1♂, Barberton, July 8, 1936, (L. J. Lipovsky), [KU].

MICHIGAN: 1♀, Ann Arbor, July 16, 1923, (E. G. Anderson), [UM]. 1♂, Agricultural College, (C. F. Baker), [USNM].

WISCONSIN: 1♀, 1♂, Milwaukee, [AMNH].

ILLINOIS: 1♂, no other data, [ANSP]. 1♀, McHenry, Sept. 1903, (A. L. Melander); 1♀, White Heath, Aug. 8, 1915; 4♂, Urbana, July 15–Aug. 12, (Terrill, E. G. Titus, Hart, Shiga, Marten); 1♂, Champaign, July 24, 1889, (Marten & Terrill); 1♀, 1♂, Savanna, July 26, 1892, (McElfresh; *in copula*); 1♂, Quincy, Aug. 11, 1889, (Hart); [all INHS].

IOWA: 7♀, Sioux City, June 19–Aug. 15, (C. N. Ainslie), [UM]. 1♂, County # 10, July 18, 1934, (Dodds); 1♂, County # 30, July 18, 1934, (Knutson); [both USNM].

ALABAMA: 1♂, Pyziton, Clay Co, (H. H. Smith), [USNM].

MINNESOTA: 1♀, Lancaster, Aug. 20, 1935, (D. Denning); 2♀, Fridley sand dunes, Anoka Co., July 24, 1923, (C. E. Mickel); 3♀, Fort Snelling, June 28, 1923, (H. H. Knight); 1♀, Traverse Co, (O. W. Oestlund); 1♀, Big Stone Co., (O. W. Oestlund); 1♂, Chicago Co., (O. W. Oestlund); 1♂, Cass Co., (O. W. Oestlund); 1♂, University Farm, Ramsey Co., July 26, 1922, (A. A. Nichol); 1♂, River near Blakeley, Sibley Co., July 17, 1922, (W. E. Hoffmann); [all UM].

KANSAS: 1♀, Manhattan, July 9, 1932, (C. W. Sabrosky), [KSAC]. 2♂, Douglas Co., July, 900 ft., [KU].

MISSOURI: 1♀, 2♂, Webster Groves, June 1928, (F. X. Williams), [FXW].

NEBRASKA: 1♂, Cambridge, July 3, 1922, (A. P. Morse), [BSNH]. 6♂, Harrison; 1♂, Meadow; [both UN; not seen].

SOUTH DAKOTA: 1♂, Waubay, Aug. 18, 1924, [CU]. 1♂, Piedmont, [ANSP].

NORTH DAKOTA: 1♂, Fargo, July 7, 1923, (Wm. Baker), [UM]. 1♂, D[akota ?] Hills, July 23, 1878, [ANSP].

MONTANA: 4♂, no other data, [ANSP]. 1♂, Bozeman, Aug 1, 1930, (A. N. Caudell), [USNM].

COLORADO: 1♀, Silver Plume, July 10, 1897, (on *Senecio*), [ANSP]. 1♂, Fort Collins, Aug. 4, 1895, (C. F. Baker), [USNM]. 9♂, no other data, [ANSP] 1♂, Ute Creek, [UN; not seen].

ARIZONA: 1♂, San Francisco Mts., Flagstaff, July 23, 1897, (R. C. Kunze), [USNM].

No Data: 1♂, Aug. 3, 1902, [AMNH; Acc. no. 4473].

Ethology.—Brues and Melander record this species as being taken in the vicinity of nests of the bee, *Halictus* (*Chloralictus*) *pruinosus* Robertson, at Woods Hole, Massachusetts. Dr. P. P.

Babiy reports that the common bee nesting in the vicinity where he captured so many *Myrmosa* in Ithaca, is *Halictus stultus* Cresson [Det. Sandhouse] and the most common Sphecid wasp is *Lindenius errans* (Fox) [Det. Krombein].

Miss Grace Sandhouse of the U. S. National Museum informs me (*in litt.*) that a male *unicolor* has been received recently bearing the label Crown Point, Indiana, April 24, 1934, (Luginbill and Painter; reared from a *Tiphia* cocoon).

Myrmosa (Myrmosa) bradleyi Roberts (Pl. XXIV, fig. 2.)

Myrmosa (*Myrmosa*) *species non descripta* Bradley, Trans. Amer. Ent. Soc., XLIII, p. 251, (1917); [♂].
Myrmosa bradleyi Roberts, Psyche, XXXVI, p. 362, (1929); [♂].

The male of *bradleyi* is immediately separated from other Nearctic forms by the erect black pubescence of the body. It is distinguished from the Palaearctic *tangerina* Mercet, which also has black pubescence, by the non-dentate lateral margins of the last abdominal tergite. The female is distinguished from that of *unicolor* Say by the shape of the head which is broad behind the eyes, and from *blakei* Bradley and *peculiaris* new species by the rounded anterior angles of the pronotum.

Mr. E. T. Cresson, Jr., has kindly compared a female of this species with the type of *blakei* and reports that they are quite different.

Type.—♂; Sacramento, California. August 25, 1916. (L. Bruner). [University of Nebraska].

Male. 7 to 11 mm. long. Black; mandibles occasionally ferruginous near the apices; legs piceous in one specimen. Head, thorax and abdomen clothed with erect moderately long dense black pubescence; legs and abdomen with sparse short appressed whitish pubescence. Wings heavily infumated; stigma and basal veins black, apical veins piceous.

Head fulgid, closely but not so coarsely reticulate as in *unicolor;* clypeus with the basal keel small and inconspicuous, not terminating in a small tubercle as in *unicolor,* the disk almost impunctate; antennal scrobes separated; ocelli normal, the postocellar distance about twice the lateral ocellar distance and a little more than half the ocellocular distance; antennae short, but more slender than in *unicolor.*

Thorax fulgid, the pronotal disk, mesonotum, scutellum and mesopleura reticulate in the same degree as the head; postscutellum and dorsum of propodeum more finely reticulate; anterior angles of pronotal disk rounded; propleura moderately rugoso-reticulate; lateral surface of propodeum with a few scattered punctures anteriorly and finely reticulate posteriorly; tegulae sparsely and minutely punctate.

Abdomen fulgid, moderately and closely punctate; last tergite with a short longitudinal fossa medianly on the declivous portion, the apical margin emarginate medianly, the lateral margin not dentate near the base; process of second sternite smaller than in *unicolor;* last sternite without a median keel, its apical margin rounded.

Female (hitherto unrecognized). 5 to 6.5 mm. long. Ferruginous; apices of mandibles, apical two or three antennal segments, legs occasionally and abdominal segments three to six, piceous to castaneous. Head and thorax rather sparsely clothed with short subappressed whitish bristles and a few erect cinereous hairs, the abdomen more densely clothed with appressed whitish pubescence and sparse erect cinereous hairs.

Head fulgid, closely and moderately coarsely punctate; clypeal spine short, as in *unicolor;* ocelli as in *peculiaris* except in one specimen where the posterior ocelli are more separated than normally.

Thorax fulgid, the dorsum closely and regularly transversely rugulose, though not so strongly as in *peculiaris;* anterior angles of pronotal disk rounded, the width there only one and a half times as great as the median length of the pronotal disk; the median length of the remainder of the thorax twice as great as the median length of the pronotal disk; upper angles of propodeum with much smaller teeth than in *peculiaris,* the width between these teeth not twice as great as the median height of the posterior surface of the propodeum; posterior surface of propodeum minutely punctate; circlet of teeth at apex of dorsum composed of more slender teeth than in *peculiaris;* propleura with moderately large punctures above merging into longitudinally rugose below; mesopleura with scattered large punctures above and scattered minute ones below; lower and posterior margins of lateral surface of propodeum with scattered minute punctures; legs strongly pilose, not conspicuously spinose, the middle and hind tibiae with a row of slender spines on the outer surface, the hind tarsi with a few scattered ones beneath.

Abdomen fulgid; first tergite transversely rugulose on the disk but not so strongly as the thoracic dorsum, the declivous anterior portion rather closely and minutely punctate; second tergite rather sparsely punctate except along the apical margin where it is very closely so; third to fifth tergites more closely punctate than the second, the last tergite with extremely close minute punctures; second sternite moderately closely punctured; succeeding sternites minutely and more closely punctured on the apical portions.

Distribution—Apparently confined to the coastal region of the western United States.

Specimens examined: 6; 2 males, 4 females.

WASHINGTON: 1 ♂, Washington S[tate], July 4, 1892, (Kincaid), [CU].

CALIFORNIA: 1♀, 1♂, Chino, (A. O. Larson; *in coitu;* on blackeyed cowpeas), [USNM]. 1♀, Piedmont, Alameda Co., July 27, 1914, (F. W. Nunenmacher), [FWN]. 1♀, Oakland, Sept. 27, 1936, (H. Leech), [UM]. 1♀, *Millbrae, July 21, 1912,* (E. C. Van Dyke), [CU].

Myrmosa (Myrmosa) blakei Bradley

Myrmosa (Myrmosa) blakei Bradley, Trans. Amer. Ent. Soc., XLIII, p. 251, (1917); [♀].

Blakei, known only from the unique female type, is separated from most Nearctic *Myrmosa* by the shape of the head which is broad behind the eyes; from *bradleyi* Roberts it is separated by the dentate anterior angles of the pronotal disk and from *peculiaris* new species by the lack of a carina running from the antennal scrobes to the inner margins of the compound eyes.

Type.— ♀ ; N[ew] Y[ork]. [Academy of Natural Sciences of Philadelphia, Type no. 4974].

Female. 4 mm. long. Ferruginous; mandibles apically, transverse band on second abdominal tergite and segments three to six, piceous. Clothed with rather sparse short subappressed pubescence, closer on the abdominal dorsum.

Head fulgid, closely and moderately coarsely punctate; clypeal spine present; ocelli arranged in an equilateral triangle, the postocellar distance slightly over half the ocelloculiar distance.

Thorax fulgid, the dorsum closely and regularly transversely rugulose; anterior angles of pronotal disk prominent and dentate; the width between the anterior angles of the pronotal disk twice as great as the median length of the disk; circlet of teeth at apex of dorsum composed of flattened teeth which are not so broad as in *peculiaris;* propleura not so strongly punctate above and rugulose below as in *bradleyi;* postero-lateral angles of the dorsum, prominent, dentate; legs not so strongly spinose as in *bradleyi,* but having the same arrangement.

Abdomen fulgid; disk of first tergite transversely rugulose, more strongly so than in *bradleyi,* without a transverse carina at the base of the disk; second segment coarsely and moderately closely punctate, the remaining segments more closely and minutely punctate; particularly the last tergite.

Male. Unknown.

Specimens examined: 1♀, (the type).

Myrmosa (Myrmosa) peculiaris new species

The shape of the head, presence of a carina from the antennal scrobes to the inner margins of the compound eyes and the low propodeum separates this species, known only from the female sex, from all other Nearctic *Myrmosa.* It may possibly be the female of one of the males described under the subgenus *Myrmosina*, in which case I doubt if that group can be maintained as a valid subgenus.

Type.[10]—♀; Onaga, K[ansa]s. August 27, 1923. (Crevecoeur). [Academy of Natural Sciences of Philadelphia, Type no. 4228].

Female. 5 mm. long. Dark ferruginous; apex of mandible, transverse band medianly on the second abdominal tergite the posterior margin of which is emarginate medianly, tergites three to six entirely and sternites three to six except the apex of the sixth, piceous. Head and thorax moderately covered with short suberect cinereous bristles, the abdomen with somewhat longer appressed whitish to cinereous pubescence and a few scattered suberect bristles.

Head fulgid, rather coarsely and closely punctate, broad behind the eyes; clypeus with the usual spine just below the antennae; a very distinct carina extending from the antennal scrobes laterad to the inner margins of the compound eyes; the latter somewhat smaller than usual, the longest diameter much less than the distance from the posterior margin of the eye to the occipital margin; ocelli arranged in an equilateral triangle, the postocellar distance only slightly greater than the lateral ocellar distance.

Thorax fulgid, the dorsum closely and regularly transversely rugulose, the anterior and posterior angles of the dorsum prominent and dentate; as viewed from above, the thorax is broadest anteriorly and conspicuously emarginate medianly; pronotal disk twice as broad at the anterior angles as its median length; the median length of the remainder of the dorsum twice as great as the median length of the pronotal disk; greatest width of posterior surface of propodeum (at lateral teeth but not including them) twice as great as the median height, the surface glabrous, moderately and finely punctate; circlet of teeth at apex of dorsum composed of very broad teeth; propleura with moderately large punctures above, merging into longitudinally rugose below; mesopleura with scattered large punctures above and numerous minute ones below; metapleura and lateral surface of propodeum with very sparse minute punctures; legs not at all spinose, only the hind tibia externally and the hind tarsi beneath with a few scattered ones.

Abdomen fulgid, first tergite transversely rugulose dorsally but more weakly than the thoracic dorsum, the declivous anterior portion minutely punctate and rounded into the dorsal surface; second segment with moderately large punctures, the succeeding segments with progressively smaller and closer punctures.

Male. Unknown.

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[10] Deposited in the type collection of the Academy of Natural Sciences through the kindness of Prof. R. H. Painter, Kansas State Agricultural College.

PALAEARCTIC SPECIES [11]

Myrmosa (Myrmosa) melanocephala (Fabricius)

Melanocephala, minuta Morawitz and *unicolor* Say form a rather close-knit group of species distinguished in the female sex by the shape of the head which is narrowed behind the eyes. *Melanocephala* females are distinguished from those of *minuta* chiefly by the presence of ocelli and from those of *unicolor* by the presence of a glabrous tubercle or cariniform process near the base of the second abdominal sternite. Males of *melanocephala* are immediately separated from all other forms by the presence of a strong median longitudinal carina on the apical half of the seventh abdominal sternite.

This species is separable into two geographical forms, typical *melanocephala* and *nigrofasciata* Yasumatsu, which are discussed separately below.

Myrmosa (Myrmosa) melanocephala melanocephala (Fabricius) (Pl. XXIV, fig. 8.)

Mutilla melanocephala Fabricius, Ent. Syst., II, p. 372, (1793); [♀]. Dalla Torre, Cat. Hym., VIII, p. 60, (1897).

Myrmosa atra Panzer, Faun. Ins. German., Heft 85, pl. 14, (1801); [♂].

Myrmosa melanocephala Latreille, Hist. Nat. Crust. Ins., XIII, p. 266, pl. 101, f. 4, (1805); [♀].—André, Spec. Hym. d'Eur. & d'Alg., VIII, pp. 103-5. 117-9, 441-2, pl. 6, figs. 1 & 2, (1900-3); [♀ ♂].

Myrmosa nigra Latreille, Gen. Crust. & Ins., I, pl. 13, fig. 8, (1806); [♂].

Myrmosa villosa Costa, Fauna Napoli., Mutillidae, p. 4, (1858); [♂ *nec* ♀].

Myrmosa longicollis Tournier, Entom. Genevois, I, p. 17, (1889); [♂ *nec* ♀].

Type.—♀; Gallia. (Bosc). [Museum National d'Histoire Naturelle of Paris—?].

Female. 3 to 8 mm. long. Black; mandibles except apices, clypeus, antennae except apical segments, antennal scrobes, thorax, legs, first and basal half of second abdominal segments, ferruginous; occasionally the thorax and legs, in part or entirely, castaneous; occasionally the normal black areas tend to be piceous; the ferruginous areas on the second segment are occasionally quite reduced in extent. Dorsum of body covered with rather dense short subappressed brownish bristles, more densely on the head and thorax than on the abdomen; head beneath, thoracic pleura and sterna and abdomen with longer subappressed whitish pubescence and a few scattered erect hairs, particularly noticeable on the abdomen beneath.

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[11] As originally prepared, this paper discussed the Palaearctic species in greater detail than here given, but owing to the available series of these species being limited, the treatment of the same here given has been reduced to the essential features and references.

Head narrowed behind the eyes; ocelli present; anterior angles of the pronotal disk rounded, not at all prominent; posterior angles of the thoracic dorsum not prominent; second abdominal sternite with a prominent median glabrous tubercle or cariniform process near the base.

Male. 5 to 11.5 mm. long. Black; tegulae and legs occasionally piceous; one specimen has the head, thorax and appendages casteneous and the abdomen ferruginous. Head and thorax densely covered with short erect cinereous pubescence particularly noticeable at the apices of the segments. Wings hyaline; infumated in the region of the stigma; stigma and nervures piceous.

Clypeus with the basal median keel well-developed and extending halfway to the apex; antennal scrobes separated; anterior angles of the pronotal disk slightly prominent but not dentate; last abdominal tergite abruptly declivous near the base and with a median longitudinal fossa, the apical margin bilobate, the lateral margin sinuate; first sternite occasionally with a pair of pits near the postero-lateral corners as in *unicolor*; second sternite with a basal process; seventh sternite with a median longitudinal keel on the apical half with a shallow concavity on each side, the apical margin broadly rounded.

Distribution.—André (1900-3) records it from England, Sweden, Belgium, Germany, Austria, Hungary, Switzerland, France, Italy and Spain. I have seen one specimen from eastern Siberia so the subspecies probably has a wide distribution over all Europe and Asia north of the Himalayas.

Specimens examined: 70; 16 females, 54 males.

Great Britain: 1♀, Sandown, I[sle] of W[ight], Aug 1-12, 1927, (G. Nixon); 1♀, Oxshott, Surrey, Sept. 14, 1924, (O. W. Richards); 1♂, Dorset, Studland, July 17, 1938; [all KVK].

Estonia: 4♂, Dorpat, [CU].

Germany: 3♀, 4♂, Fürstenberg i[m] M[ecklenberg], June 12–July 31, (F. W. Konow); 1♀, Finkenkrug, [Brandenburg], (R. Korschefsky); 1♂, Berlin, (Lichtwardt); 2♂, Berlin, June–July, (Grunewald); 1♂, Morav[ia]; 1♂, Brandenburg, Aug. 11, 1918; 4♂, Thal[i]. Thüring[ia], Aug. 1894; [all DEI]. 1♂, Offenburg, July 7, 1901, (Eaton), [UM]. 2♀, 1♂, Villach, Kaernten, [Austria], 1918, (Troll); 1♀, Landl, Tirol, [Austria], Aug. 16, 1911; 1♀, Türkinschause, Austr[ia] inf., Aug. 27, 1885, (Handlirsch); 1♂, Lunz, Austr[ia] inf., Aug. 1909, (Maidl); 3♂, Eichkogel, Mödling, [Austria], Sept. 8, 1914; 1♂, Gars, Austr[ia] inf., Aug. 15, 1916; 1♂, Nied. Ost. Rohrwald, [Austria], June 17, 1911, (Maidl); 1♀, Prachatitz, Bohemia, July 24, 1884, (Handlirsch); [all Wien]. 1♂, Piesting, Tschek[oslavakie], 1872, [CU].

Switzerland: 1♂, Göschenen, Uri, June 20, 1912, [BM].

Italy: 1♂, Trieste, Sept. 8, (Graeffe); 1♂, Tolmein, (Graeffe); [both Wien].

YUGOSLAVIA: 1 ♂, Radein, S. Tirol, [Wien].
HUNGARY: 1 ♀, 1 ♂, no other data, [UM].
IRAN: 1 ♀, (Kraak), [DEI].
U.R.S.S.: 1 ♂, Marcha bei Jakutsk, North Siberia, June 3, 1900, [BM].
Miscellaneous: 3 ♀, 21 ♂, labels lacking or illegible, [Wien, DEI, BM, CU].

Ethology.—Kieffer reports that this species is parasitic on *Oxybelus uniglumis* (Linnaeus). Minkiewicz notes that this cannot be the only host of *melanocephala* since he has found the *Myrmosa* very abundantly at Kazimierz-sur-Wisla, Poland while he has never encountered an *Oxybelus* in the same locality in four summer's collecting.

Myrmosa (Myrmosa) melanocephala nigrofasciata Yasumatsu

Myrmosa nigrofasciata Yasumatsu, Trans. Sapporo Nat. Hist. Soc., XI, pp. 221-6, pl. 3, figs. 1-20, (1931); [♂ ♀].

Through the kindness of Dr. K. Yasumatsu of the Kyûshû Imperial University, Japan, I have had an opportunity to examine the holotype and allotype of *nigrofasciata.* I have been unable to find characters of specific importance separating *nigrofasciata* from *melanocephala* so have chosen to regard the former as a subspecies of the latter.

The male differs from typical *melanocephala* in the generally darker pubescence of the body and the sparser clypeal puncturation. The female differs from typical *melanocephala* in the generally closer and coarser puncturation of the body and the color of the clypeus and mesonotum which is black.

Specimens examined: 2; 1 male, 1 female (the holotype and allotype).
JAPAN: 1 ♂, 1 ♀, Hikosan, Buzen, Kyûshû, Aug. 2, 1930, (K. Okabe), [KIU].

Myrmosa (Myrmosa) minuta Morawitz

Myrmosa minuta Morawitz, Hor. soc. ent. Ross., XXVIII, p. 328, (1894); [♀].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 124, 443, (1900-3); [♀].

Mutilla myrmosina Dalla Torre, Cat. Hym., VIII, p. 65, (1897); [nom. nov. for *Myrmosa minuta* Morawitz *nec Agama minuta* Blake, both placed in the blanket genus *Mutilla* by Dalla Torre].

Myrmosa myrmosina Skorikov. Annu. Mus. Zool. Acad. Sci. Leningrad, XXX, p. 245, (1929); [♀].

This species, known only from the female sex, is distinguished from *melanocephala* (Fabricius) by the lack of ocelli. It is quite possible that re-examination of the type with higher magnification and better light may reveal ocelli, in which case this species would probably fall as a synonym of *melanocephala*. Morawitz does not mention some of the structural characters which I use in my key to the species, but he states that it is similar to *melanocephala* so I have keyed it out with that species.

Type. — ♀; Hodsha-kala, Turkmenistan, U.R.S.S. (Pomeranzev). [Zoological Museum, Leningrad—?].

Male. Unknown.

Myrmosa (Myrmosa) frater (Ed. Saunders) (Pl. XXIV, fig. 4.)

Mutilla frater Ed. Saunders, Ent. Month. Mag., p. 228, (1899); [♂].

Myrmosa frater André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 116-7, 443, (1900-3); [♂].

This species, known only from the male sex, is most likely to be confused with *melanocephala* (Fabricius), *thoracica* (Fabricius) and *tangerina* Mercet. From the former it is distinguished by the lack of a median longitudinal keel on the apical half of the last abdominal sternite, from *thoracica* by the lateral margin of the last abdominal tergite which is not dentate near the base and from *tangerina* by the whitish pubescence of the body.

Type.— ♂; Le Tarf, Algeria. July 24-26, 1896. (Eaton; on *Foeniculum*). [British Museum (Natural History)].

Male. 6 to 9.5 mm. long. Black; mandibles near apices, pronotum, propleura, mesonotum, scutellum and tegulae, ferruginous; occasionally there is no ferruginous on the thorax, or the scutellum is black; antennae and legs occasionally piceous. Body clothed with inconspicuous rather sparse erect whitish to cinereous pubescence which is especially dense on the apical portion of the last abdominal tergite. Wings hyaline, usually with an infumated band extending across the fore wing from the stigma and marginal cell; stigma and basal veins black, apical nervures testaceous.

Clypeus with the keel prominent, extending nearly to the apex; antennal scrobes united medianly forming a low shelf-life projection bounded anteriorly by a carina; anterior angles of the pronotal disk rounded, not at all prominent; last abdominal tergite not abruptly declivous, the apical margin truncate and the lateral margin sinuate; first sternite without pits; second sternite with a basal process; seventh sternite without a keel; the apical margin angulately emarginate medianly.

Female. Unknown.

Distribution.—Recorded only from Algeria so far.

Specimens examined: 3 males.

ALGERIA: 2♂, Le Tarf, July 24-25, 1896, (Eaton: on *Foeniculum*), [BM; paratypes]. 1♂, same data but July 24, 1896, [UM; probably a paratype, but not so labeled].

Myrmosa (Myrmosa) tangerina Mercet (Pl. XXIV, fig. 3.)

? *Myrmosa obscuripes* Ed. Saunders (*nec* Tournier); Ent. Month. Mag. xxvi, p. 290, (1890); [♀ ♂].

Myrmosa tangerina Mercet, Bol. Soc. Esp. Hist. Nat., xiii, pp. 257-9, (1913); [♀ ♂].

The black pubescence of the male distinguishes it from other Palaearctic *Myrmosa*. There is a possibility that there are two species confused under this name since the specimen from Tangier before me has the lateral margin of the last (seventh) tergite dentate near the base while Mercet states that the lateral margins of the *sixth* tergite are not dentate. Both André and Mercet were mistaken in their application of this character—they consistently state sixth tergite dentate or not whereas the sixth is never dentate and the seventh may or may not be dentate. Pending an examination of Mercet's type series of this species, I have chosen to place the specimen before me under this name. This specimen is probably one of those recorded by Ed. Saunders (1890) as *obscuripes* Tournier, which species has been synonymized with *thoracica* (Fabricius) by André. If Saunders' assumption proves correct, *obscuripes* will have to be used in place of *tangerina*.

I have not seen a female of *tangerina* but Mercet states that it is close to *longicollis* Tournier and *ephippium* (Fabr.) (= *thoracica* of this paper) differing by reason of its smaller eyes, indistinct ocelli and the rounded angles of the thorax. The notes on the female given below are translated from the original.

Type.—♂; Tangier, Morocco. (M. de la Escalera). [Collection unknown].

Male. 6.5 mm. long. Black; pronotum, propleura, mesonotum, scutellum and tegula, ferruginous. Head, thorax and abdomen covered with short sparse erect black pubescence. Wings subhyaline, the fore wing with a narrow infumated band running into the third discoidal cell from the stigma; stigma and basal veins black, apical veins fuscous.

Clypeus with the median longitudinal keel prominent, extending nearly to the apex; antennal scrobes separated medianly; anterior angles of the pronotal disk rounded, not prominent; last abdominal tergite not abruptly declivous, the apical margin broader than in *frater* and truncate, the lateral margin dentate near the base, the apical portion of the disk without a fossa or concavity; first sternite without pits; second sternite with a basal process; last sternite with the apical margin roundly and more deeply emarginate than in *frater*.

Female. 4-6 mm. long. Black: thorax and mandibles ferruginous; antennae and legs obscure greyish; posterior margin of first abdominal tergite only with slightly colorless portions. Head with short greyish pilosity; abdominal segments with some whitish hairs on the posterior margins which are not thick enough to form a fringe.

Ocelli lacking; thoracic dorsum with the anterior angles rounded and the posterior angles almost indistinct.

Distribution:—Recorded from Morocco only.

Specimens examined: 1 male.

MOROCCO: 1♂, Tangier, (J. J. Walker), [BM].

Myrmosa (Myrmosa) Spinolae Lepeletier

Myrmosa Spinolae Lepeletier, Hist. nat. Ins. Hym., III, p. 591, (1845); [♀].

Mutilla spinolae Dalla Torre, Cat. Hym., VIII, p. 87, (1897).

This species, known only from a female from an unknown locality, is apparently closely related to *thoracica* (Fabricius) and *longicollis* Tournier since the first abdominal tergite has an apical white band. It is separated from both by the antennae and thorax which are entirely black except for the prothorax.

Type.—♀; locality unknown. (Spinola Collection). [Museo Zoologia et Anatomia Comparata della R. Universita of Turin, Italy - ?].

Female. 7 mm. long. "Head black. Antennae of same color. Prothorax ferruginous. Mesonotum, scutellum and metathorax black. Abdomen black; its first segment with a white band at the posterior margin. Legs ferruginous."

Male. Unknown.

Myrmosa (Myrmosa) thoracica (Fabricius) (Pl. XXIV, fig. 7.)

Hylaeus thoracicus Fabricius, Ent. Syst., II, p. 304, (1793); [♂].

Mutilla ephippium Panzer, Faun. Ins. German., IV, Heft 46, pl. 20, (1797); [♂]; [*nec Tiphia ephippium* Fabricius, 1775].

Myrmosa ephippium Panzer, Krit. Revis., II, p. 137, (1806); [♂].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 109-10, 113-6, 442-3, (1900-3); [♀ ♂].

Myrmosa thoracica Illiger, Mag. f. Insektenk., VI, p. 194, (1807); [♂].

Myrmosa dubia Costa, Fauna Napoli., Mutill., p. 7, pl. 24, fig. 5, (1856); [♀].

Myrmosa obscuripes Tournier, Entom. Genevois, I, p. 35, (1889); [♀].
Mutilla dubia Dalla Torre, Cat. Hym., VIII, p. 33, (1897).
Mutilla ephippia Dalla Torre (in part), Cat. Hym., VIII, p. 34, (1897).
Mutilla obscuripes Dalla Torre, Cat. Hym., VIII, p. 67, (1897).

Thoracica belongs to a group of closely related species including *frater* (Ed. Saunders), *longicollis* Tournier, *tangerina* Mercet and *Spinolae* Lepeletier. The female is distinguished from that of *longicollis* by the rounded anterior angles of the thoracic dorsum, from that of *tangerina* by the presence of a white band on the apical margin of the first abdominal tergite and from that of *Spinolae* by the entirely ferruginous thorax. The male is distinguished from that of *frater* by the lateral margin of the last abdominal tergite which is dentate, from that of *longicollis* by the non-dentate anterior angles of the prothorax and sparsely punctured tegulae and from that of *tangerina* by the greyish pubescence of the body.

Type.—♂ ; Italy. [Collection unknown].

Male. 5 to 10 mm. long. Black; mandibles near apices, tip of scape above, pronotum, propleura, mesonotum, tegulae and occasionally the scutellum, ferruginous; in one specimen the thorax is entirely black; legs occasionally piceous. Body clothed with inconspicuous short erect whitish to greyish pubescence. Wings subhyaline, the forewing with a narrow infumated band running from the stigma down into the third discoidal cell; stigma and nervures piceous.

Clypeus with the median longitudinal keel prominent; extending nearly to the apex; antennal scrobes united medianly forming a low shelf-like projection which is bounded anteriorly by a carina; anterior angles of the pronotal disk prominent but not dentate; last abdominal tergite declivous but not abruptly so, its lateral margin dentate near the base, its apical margin emarginate, and the disk somewhat concave on the apical portion; first sternite without pits near the postero-lateral corners; second sternite with a median process basally; last sternite with a deep angulate emargination on the apical margin.

Female. 4.5 to 6 mm. long. Black; mandibles except apices, clypeus, antennae, antennal scrobes, thorax and legs, ferruginous; first abdominal tergite with a broad ivory-colored band at the apex. Head sparsely covered with inconspicuous short subappressed brownish bristles; thorax with inconspicuous short subappressed whitish bristles dorsally; abdomen with somewhat longer decumbent fine white pubescence particularly noticeable at the apices of the segments.

Head broad behind the eyes; a very indistinct carina running from the antennal scrobes laterad to the inner margin of the compound eyes; ocelli indistinct but present; anterior angles of the pronotal disk prominent but not dentate; second abdominal sternite without a median glabrous tubercle at the base.

Distribution.—André (1900-3) records this species from France, Italy, Sardinia, Sicily, Spain, Austria, Hungary, Algeria, Tunis and Morocco.

Specimens examined: 8; 1 female, 7 males.
ITALY: 1 ♂, no other data, (Konow), [DEI].
ALGERIA: 1 ♂, Le Tarf, July 24, 1896, (Eaton), [BM].
GREECE: 2 ♂, Attica, (Th. Krüper), [Wien]. 1 ♂, Peleponnes, (Leonhardi), [DEI].
EUROPE: 1 ♀, 1 ♂, no other data, [BM].
Miscellaneous: 1 ♂, no data, (Graeffe), [Wien].

Nomenclatorial notes.—Dr. Olaw Schröder of the Zoological Museum of the University of Kiel, Germany has very kindly compared some specimens sent him with the type of *Tiphia ephippium* Fabricius.[12] He informs me that the Fabrician type is identical with *Myzine xanthonotus* (Rohwer) from the West Indies. Consequently *thoracica* will have to be used for this widespread European *Myrmosa* since it is the next available name. This confusion about the identity of *ephippium* arose by the action of Panzer in placing *thoracica* as a synonym of *ephippium*. André (1900-3) placed *dubia* Costa and *obscuripes* Tournier as synonyms of *thoracica*.

Myrmosa (Myrmosa) longicollis Tournier

This species is divisible into two geographical races which are discussed separately below.

Myrmosa (Myrmosa) longicollis longicollis Tournier

Myrmosa longicollis Tournier, Entom. Genevois, I, p. 17, (1889); [♀ *nec* ♂].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 107-8, 443, (1900-3); [♀ *nec* ♂].—André, Ann. Soc. Ent. France, LXXII, p. 417, (1903); [♂].
Mutilla longicollis Dalla Torre, Cat. Hym., VIII, p. 54, (1897).

The female of this subspecies is very similar to that of *thoracica* (Fabricius) and is distinguished by the dentiform anterior angles of the pronotum and the dull punctato-reticulate head and thorax. The male which Tournier wrongly associates with this female is

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[12] Fabricius, Syst. Ent., p. 353, 1775.

melanocephala (Fabricius). André (1903) describes the male which had been taken in copula with a female indicating that it is close to *thoracica* and differing in having dentate anterior angles of the prothorax.

Type.—♀; Sarepta, U.R.S.S. [Collection unknown].

Female. 4 to 7 mm. long. Black; mandibles except apices, clypeus except spine and apical margin, antennae except scape, and thorax, ferruginous; legs piceous to ferruginous; first abdominal tergite with a rather broad ivory-colored band occupying the apical half of the dorsal disk. Head sparsely covered with short subappressed brownish bristles; thorax and abdomen with short subappressed whitish pubescence which is especially noticeable at the apices of the segments.

Head broad behind the eyes; a very indistinct carina running from the antennal scrobes laterad to near the inner margins of the compound eyes; ocelli small and indistinct; the anterior and posterior angles of the thoracic dorsum prominent and dentate; second abdominal sternite without a median glabrous tubercle basally.

Male. 10 to 11 mm. long. Black; pronotum, mesonotum and scutellum, ferruginous; infumation of the fore wing is vague and more extended than in *ephippium* (=*thoracica*), occupying almost the apical half; the other characters of color and vestiture are similar to those of *ephippium*.

Pronotum with the anterior angles prominent and prolonged into a very distinct tooth; lateral teeth of the sixth (!) abdominal tergite are narrower and more spiniform than in *ephippium*, though rounded at the tip.

Distribution.—André (1900-3) records this form from France, Spain, Italy and Russia.

Specimens examined: 1 female.

SPAIN: 1♀, Gibraltar, (J. J. Walker), [BM].

Myrmosa (Myrmosa) longicollis var. **tenietensis** André

Myrmosa longicollis var. *tenietensis* André, Spec. Hym. d'Eur. et d'Alg., VIII, p. 108, (1900); [♀].

Myrmosa longicollis var. *tenetiensis* (!) Bischoff, Arch. f. Naturg., LXXXVI, Abt. A, Heft 1, p. 53, (1920); [♀].

Differs from typical *longicollis* by the entirely black abdomen. I have seen no specimens but presumably the structural characters are the same. If so, the dentate anterior angles of the thorax will separate *tenietensis* from *tangerina* Mercet which also has an entirely black abdomen.

Type.—♀; Teniet-el-Haad, Algeria. [Collection unknown].

Male. Unknown.

Myrmosa (Myrmosa) nigriceps S. S. Saunders (Pl. XXIV, fig. I.)

Myrmosa nigriceps S. S. Saunders, Trans. Ent. Soc. London, (2), I, p. 69, pl. 6, fig. 1, (1850); [♂].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 111-3, 443, (1900-3); [♂].—Bischoff, Arch. f. Naturg., LXXXVI, Abt. A, Heft 1, p. 53, (1920); [♀ ♂].

Mutilla nigriceps Dalla Torre, Cat. Hym., VIII, p. 66, (1897).

This species is closely related to the *thoracica* (Fabricius) complex but is immediately separated by the large size and the long thick fringes of pubescence at the apices of the abdominal segments in the male and the female which is close to *brunnipes* Lepeletier is distinguished by the larger size and the lack of dark suberect bristles on the dorsum of the abdomen.

Type.— ♂ ; Nicopolin, near Sinum Ambracicum, Epirus, Greece. June. (S. S. Saunders). [British Museum (Natural History)].

Male. 14.5 to 17 mm. long. Black; mandibles near apices, tegula, entire thoraric dorsum, propleura and upper portion of lateral surface of propodeum, ferruginous. Head and thorax clothed with short suberect inconspicuous cinereous pubescence, denser on the clypeal disk than elsewhere; abdomen with dense long decumbent fringes of whitish hair at the apices of tergites one to six and sternites two to six, the remainder of the segments rather sparsely and inconspicuously clothed with shorter decumbent cinereous to whitish pubescence. Wings strongly infumated; stigma piceous, nervures testaceous.

Clypeus with the basal keel small, low and inconspicuous; antennal scrobes united forming a low shelf-like projection which is bounded by a carina anteriorly; anterior angles of the pronotal disk prominent and dentate; last abdominal tergite not abruptly declivous at the middle, with a median depression or concavity near the apex, the lateral margin dentate near the base and the apical margin broadly emarginate; first sternite without pits near the postero-lateral corners; second sternite with a median process near the base; last sternite without a keel, the apical margin angulately emarginate medianly.

Female. 12 mm. long. Coloration as in *cognata* (=*brunnipes*), except the legs are more heavily infuscated; appressed pubescence of the head much thicker, the longer erect bristles between it missing; subappressed pubescence of the thoracic dorsum is somewhat thicker and lighter.

The fourth (!) flagellar segment is more strongly nodosely produced beneath than in *brunnipes;* anterior angles of the thoracic dorsum not produced.

Distribution.—So far recorded only from Greece. Bischoff describes the female from Saloniki.

Specimens examined: 1♂, (*ex coll.* Kuper), [BM].

Myrmosa (Myrmosa) brunnipes Lepeletier (Pl. XXIV, fig. 11.)

Myrmosa brunnipes Lepeletier, Hist. Nat. Ins. Hym., III, p. 590, (1845); [♀].—Minkiewicz, Fragm. Faun. Mus. Zool. Polon., II, pp. 194, 202-8, 211, pl. 9, figs. 1-11, (1935).

Myrmosa nigra Giraud (*nec* Latreille), Verh. zool. bot. Ver. Wien, VI, p. 183, (1856); [♂].

Myrmosa cognata Costa, Fauna Napoli., Mutill., p. 6, pl. 24, f. 4, (1858); [♂].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 105-7, 119-22, 442, (1900-3); [♀ ♂].

Myrmosa villosa Costa, Fauna Napoli., Mutill., p. 4, (1858); [♀ *nec* ♂].

Mutilla cognata Dalla Torre, Cat. Hym., VIII, p. 25, (1897).

Myrmosa brunneipes (!) Bischoff, Arch. f. Naturg., LXXXVI, Abt. A, Heft 1, p. 53, (1920); [♀ ♂].

The simple second abdominal sternite immediately separates the male of *brunnipes* from those of all other species of the subgenus *Myrmosa.* The females are separated from other Palaearctic forms, except *tangerina* Mercet, *longicollis* Tournier, *thoracica* (Fabricius) and *nigriceps* S. S. Saunders, by the shape of the head which is not narrowed behind the eyes. From the species enumerated above, *brunnipes* is separated from all but *nigriceps* and *tangerina* by lack of an ivory-colored band at the apex of the first abdominal tergite. It is separated from *tangerina* by the ferruginous first abdominal tergite and from *nigriceps* by the smaller size and presence of suberect brownish hairs on the abdominal dorsum.

Type.—♀; France. (Serville). [Museum National d'Histoire Naturelle of Paris].

Female., 5-9 mm. long. Black; mandibles except apices, clypeus, antennal scrobes, antennae, thorax, legs, first segment of abdomen, second tergite basally, second sternite entirely and occasionally the apices of the remaining segments, ferruginous; head, apical half of antennae, posterior surface of propodeum, declivous portion of first abdominal tergite and femora, occasionally piceous. Body with moderately dense short suberect whitish to dark brown bristles.

Head broad behind the eyes; ocelli indistinct but present; the third segment of the antennal flagellum is broader than long, angulate at the middle; anterior angles of the thoracic dorsum prominent and slightly dentate, the posterior angles not dentate; second abdominal sternite without a median glabrous tubercle basally.

Male. 4.5 to 10 mm. long. Black; mandibles ferruginous near the apices; antennae, tegulae, legs and abdomen, occasionally piceous. Head and thorax rather closely covered with short inconspicuous erect cinereous to dark brown pubescence; abdomen with subappressed whitish pubescence and short scattered black bristles. Wings hyaline; stigma and nervures piceous; second submarginal cell pentagonal.

Clypeus convex, the median carina extending two-thirds or more of the distance to the apex, low and not raised into a keel; antennal scrobes separated; anterior angles of the pronotal disk rounded, slightly prominent; last abdominal tergite without a median fossa or concavity, evenly convex when viewed from the side, the lateral margin not dentate near the base, the apical margin rounded; first sternite without pits near the posterolateral corners; second sternite without a median process near the base; seventh sternite broadly and shallowly emarginate apically.

Distribution.—André (1900-3) records this species from France, Spain, Italy, Sicily, Corsica, Sardinia, Austria, Hungary, Russia, Greece and Algeria and Minkiewicz (1935) records it from Poland.

Specimens examined: 15; 4 females, 11 males.

FRANCE: 1♀. Ludon, Gironde, [Wien].

GERMANY: 1♂, Morav[ia], (Konow), [DEI].

ITALY: 1♂, Aspromonte, Calabria, 1914. 2♂; Alto, Calabria, 1850 m. alt., (both Paganetti), [both DEI].

HUNGARY: 1♂, Bosarkany, July 29, 1912, (Maidl), [Wien].

YUGOSLAVIA: 1♂, Klissa, Dalmatia, [Wien].

ALBANIA: 1♂, Kula Ljums, Alban. Exped., June 7-14, 1918, [Wien].

RUMANIA: 2♀, Czernovitz, Bukovina, [Wien].

CRETE: 2♂, March-June, 1914, (Paganetti), [DEI].

MANCHUKUO: 1♂, Sinking, June 30, 1937, (Z. Oono), [KIU].

Miscellaneous: 1♀, 1♂, [CU].

Ethology.—*M. brunnipes* has been reported by Minkiewicz as visiting the nesting burrows of *Thyreopus peltarius* Schreb. and *Cerceris rybyensis* Linn. of the Schecoid wasps and *Halictus major* Nyl., *H. morio* Fabr., and *H. pauxillus* Schck. among the bees at Kazimierz-sur-Wisla, Poland. A cocoon was found in the gallery of an *H. major* nest. *Brunnipes* is an inveterate enemy of the *Halicti* and Minkiewicz reports on battles between the two at the entrance to the bee's nest. In four summers' collecting this author never saw the females of *brunnipes* at flowers. He notes that they are often found running over the leaves of such low-growing plants as *Solidago virgo-aurea,* hazel trees and yoke-elms and surmises that they may be searching for honeydew secretions of aphids since they will eat honey when kept in captivity. The females spend the nights in burrows in the ground.

MYRMOSINA new subgenus

GENOTYPE: *Myrmosa (Myrmosina) texana* new species.

The present group, of which only males are known, is distinguished from the subgenus *Myrmosa,* except *brunnipes* Lepeletier, by the absence of a process on the second abdominal sternite. From *brunnipes* it is separated by the abruptly declivous last abdominal tergite. The dorso-ventral channel on the ental surface of the squamae of the male genitalia immediately separates males of *Myrmosina* from those of the other two subgenera. From *Myrmosula* Bradley it is separated by the presence of a process on the first abdominal sternite. As pointed out under the discussion of the relationships of the various subgenera, *Myrmosina* is not an annectant between *Myrmosa* and *Myrmosula.* At present only the males of this subgenus are known unless the female described here as *Myrmosa* (*Myrmosa*) *peculiaris* new species should be the opposite sex of one of the males, in which case I doubt whether *Myrmosina* can be maintained as a discrete group.

Subgeneric characters.—In addition to the characters given under the generic diagnosis, species of the subgenus *Myrmosina* have the following characters; clypeus with a short median longitudinal keel at the base; second submarginal cell of forewing triangular; last abdominal tergite abruptly declivous posteriorly; only the first abdominal sternite with a median process near the base, the second sternite unarmed; hypopygium composed of a median spear-shaped process and a pair of lateral spine-like processes; ental surface of squama with a semi-circular channel running in a dorso-ventral direction.

Distribution.—From the material at hand, *Myrmosina* seems to be restricted to the Great Plains region of the United States.

Component Species.—Two species are known at present which may be referred to this group, one of which is separable into two distinct geographic forms, which may be separated by the following key.

Key to the Forms of the Subgenus Myrmosina

1. Ocelli normal, not greatly enlarged, the diameter of the anterior ocellus only one-third as great as the postocellar distance; process of first abdominal sternite thickened, presenting a definite flattened surface when viewed from the rear; in lateral view this process is not emarginate posteriorly. .... *texana* new species

Ocelli greatly enlarged, the diameter of the anterior ocellus almost as great as the postocellar distance; process of first abdominal sternite blade-like, without a flattened surface when viewed from the rear....2

2. Abdomen black; process of first abdominal sternite emarginate posteriorly when viewed from the side....*nocturna nocturna* new subspecies

Abdomen ferruginous; process of first sternite not emarginate posteriorly when viewed from the side...*nocturna rufigastra* new subspecies

Myrmosa (Myrmosina) texana new species

This species is closely related to *Myrmosa* (*Myrmosina*) *nocturna* new species and may be readily separated by the characters given in the foregoing key. The genitalia do not differ from those of *nocturna.*

Type.[18]—♂; McKinney, Texas. July 15, 1929. (J. N. Roney —Texas A. & M. Acc. no. 6336). [Academy of Natural Sciences of Philadelphia, Type no. 4229].

Male. 11 mm. long. Black; mandibles medianly and antennal scrobes, ferruginous. Inconspicuously clothed with short erect grey pubescence; apices of abdominal segments with a fringe of sparse semi-erect cinereous hairs. Wings hyaline, the fore wing slightly infumated from the basal vein to the apex; stigma and basal veins of fore wing dark brown, the remaining veins testaceous.

Head subopaque, coarsely and closely reticulate; clypeus with a longitudinal median keel extending from between the antennae to about the middle of the segment, the median third of the apical margin emarginate; ocelli normal in size, the anterior ocellus only one-third of the postocellar distance, the latter slightly shorter than the ocellocular distance; flagellar segments somewhat excavate beneath.

Thorax subopaque; pronotal disk, mesonotum, scutellum and mesopleura more coarsely reticulate than the head; propleura and lateral surface of propodeum sparsely variolate; dorsal and posterior surfaces of propodeum closely variolate, the dorsal surface with a wide longitudinal channel; tegulae dull, with a few punctures.

Abdomen fulgid, moderately pitted though not so closely as the propodeum; last tergite abruptly declivous, with a short median longitudinal fossa near the middle, the apical margin truncate, the lateral margin dentate near the base; process of first sternite thickened, presenting a definite posterior surface when viewed from the rear, the posterior margin not emarginate when viewed from the side; last sternite finely and sparsely punctured, its apical margin emarginate.

Female. Unknown.

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[18] Deposited in the type collection of the Academy of Natural Sciences thru the kindness of Prof. H. J. Reinhard, Texas Agricultural and Mechanical College.

Paratype.—1 ♂; Dac. [=Dakota]. [ANSP].

The paratype is 9 mm. in length and the legs and abdominal sternites are castaneous.

Myrmosa (Myrmosina) nocturna new species

This species is closely related to *Myrmosa* (*Myrmosina*) *texana* new species and may be readily separated by the characters mentioned in the preceding key. *Nocturna* is divisible into two geographic forms which are differentiated in the foregoing key and discussed separately below.

Myrmosa (Myrmosina) nocturna nocturna new subspecies
(Pl. XXIV, fig. 9.)

The black abdomen distinguishes this form from *nocturna rufigastra* new subspecies. The genitalia of both subspecies are identical.

Type.[14]—♂; Dickinson, Tex[as]. June 1929. (F. M. Hull—Texas A. & M. Acc. no. 6337). [Academy of Natural Sciences of Philadelphia, Type no. 4230].

Male. 11.5 mm. long. Black; palpi, mandibles medianly and on inner edge, apex of scape and antennal scrobes at apex, ferruginous. Inconspicuously clothed with erect short grey pilosity; apices of abdominal segments with a fringe of sparse semi-erect cinereous hairs. Wings hyaline, the fore wing slightly infumated from the middle of the first discoidal cell to the apex; stigma, subcostal and externo-median veins of the fore wing dark brown, the remaining veins testaceous.

Head fulgid, coarsely and closely reticulate; clypeus with a longitudinal median keel from between the antennae to about the middle of the segment, the median third of the apical margin emarginate; ocelli greatly enlarged, the diameter of the anterior ocellus almost as great as the postocellar distance, the latter equal to the ocellocular distance; flagellar segments somewhat excavate beneath.

Thorax fulgid; pronotum, mesonotum, scutellum and mesopleura coarsely reticulate; postscutullum and propodeum closely variolate; the lateral surfaces of the propodeum much more closely pitted than in *texana*, the dorsal surface with a median longitudinal channel; tegula shining, with a few punctures.

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[14] Deposited in the type collection of the Academy of Natural Sciences thru the kindness of Prof. H. J. Reinhard, Texas Agricultural and Mechanical College.

Abdomen fulgid, about as closely and coarsely pitted as the propodeum; last tergite abruptly declivous with a median longitudinal fossa on the declivous portion which is longer and deeper than in *texana*, the apical margin slightly emarginate, the lateral margin dentate at the base; process of first sternite much thinner than in *texana*, without a definite posterior surface, and the posterior margin slightly emarginate when viewed from the side; last sternite finely and closely punctate, its apical margin shallowly biemarginate.

Female. Unknown.

Paratypes.—13 males, as follows: 1 ♂, Richmond, Texas; June 22, 1917; (Cornell University Biological Expedition); [CU]. 1 ♂, Bowie County, Texas; August 16, 1928; (A. M. James); [KU].

4 ♂ ; Sabine R[iver] Ferry opp[osite] Orange, [Texas], Louisiana; June 20, 1917. 1 ♂ ; same data; [taken in light trap]. (All Cornell University Biological Expedition). [All CU].

1 ♂ ; K[ansa]s; [ANSP]. 1 ♂ ; Lawrence, Kansas; Sept. 20, 1936; (M. W. Sanderson). 1 ♂ ; same locality; Sept. 21, 1936; (L. S. Henderson). 1 ♂ ; Kan[sas]; (Snow). 1 ♂ ; Douglas County, Kansas; July; (E. S. Tucker). 1 ♂ ; same locality; 900 ft.; (F. H. Snow). [All KU].

The paratypes vary from 9-16 mm. in length and differ structurally as follows: antennae and legs piceous in several specimens; propodeum not so closely reticulate in several specimens; process of first abdominal sternite more hooked in a few.

Myrmosa (Myrmosina) nocturna rufigastra new subspecies

This subspecies is distinguished from typical *nocturna* by the ferruginous abdomen and the posterior margin of the process of the first abdominal sternite which is not emarginate when viewed laterally.

Type.— ♂ ; Brownsville, Texas. June. [Illinois Natural History Survey].

Male. 11.5 mm. long. Differs from typical *nocturna* as follows: tegulae and abdomen ferruginous; posterior margin of process of first abdominal sternite not emarginate when viewed from the side.

Paratypes.—1 ♂ ; Brownsville, Tex[as]; (Dorner); [UM]. 4 ♂ ; same data as type; [KU].

The paratypes vary from 8.5 to 11 mm. long and the antennae and legs are piceous in some.

Subgenus **MYRMOSULA** Bradley

Myrmosa Blake, Trans. Amer. Ent. Soc., VII, p. 254, (1879).—Blake, Trans. Amer. Ent. Soc., XIII, p. 278, (1886).—Cresson, Trans. Amer. Ent. Soc., Suppl., XIV, p. 267, (1887).—Fox, Journ. N. Y. Ent. Soc., p. 53, (1893). —Fox, Trans. Amer. Ent. Soc., XXV, p. 286, (1899).—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 13, (1903).—Ashmead, Canad. Ent., XXXV, p. 202, (1903).

Mutilla (in part) Cresson, Trans. Amer. Ent. Soc., XIV, Suppl., p. 264, (1887).—Dalla Torre, Cat. Hym., VIII, p. 5, (1897).

Brachycistis (♀ *nec* ♂) Fox, Trans. Ent. Soc., XXV, p. 285, 1899.—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 9, (1903).—Ashmead, Canad. Ent., XXXV, p. 202, (1903).—Bradley, Trans. Amer. Ent. Soc., XLIII, p. 280, (1917).

Myrmosa (*Myrmosula*) Bradley, Trans. Amer. Ent. Soc., XLIII, p. 249, (1917); [♂ only].

Myrmosula Bridwell, Proc. Hawaiian Ent. Soc., IV, p. 392, (1920); [♂ only].

GENOTYPE: *Myrmosa parvula* Fox, 1893 [=*Myrmosula parvula* (Fox) =*Myrmosa* (*Myrmosula*) *parvula* Fox]. (By designation of Bridwell, 1920.)[15]

Bradley (1917) established *Myrmosula* as a subgenus of *Myrmosa* with two included species but without designating a genotype. In 1920 Bridwell designated *parvula*, one of the two included species, as genotype and indicated that *Myrmosula* should be considered a distinct genus.

Subgeneric characters.—In addition to the features given in the generic characterization, *Myrmosula* has the following. *Male.*—Clypeus convex, without a median longitudinal keel at the base; mandibles bidentate apically with a large tooth medianly along the inner margin; second submarginal cell pentagonal; last abdominal tergite convex when viewed laterally, not abruptly declivous; first and second abdominal sternites unarmed at base; hypopygium simple, lateral processes lacking, the median process broad basally and slightly narrowed toward the apex. *Female.*—Clypeus unarmed basally; mandibles with a lamelliform process on the inferior edge basally; ocelli lacking; body very minutely punctured and not coarsely sculptured

Distribution.—This subgenus has a wide distribution in the Nearctic region, though apparently confined to the Upper and Lower Austral and Sonoran subregions

Component species.—Only four species are known at present which may be referred to this group. These forms may be separated by the following key.

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[15] Proc. Hawaiian Ent. Soc., IV, p. 392.

Key to the Species of the Subgenus Myrmosula

1. Winged; males 2
   Wingless; females 3
2. Third submarginal cell narrowed above, higher than long; clypeus only tumid medio-apically; abdomen black, except for the extreme apex which may be ferruginous.............................*parvula* Fox
   Third submarginal cell quadrate, longer than high; clypeus with a small beak-like process medio-apically; abdomen ferruginous. *rufiventris* Blake
3. Lower margin of lamella on inferior edge of mandible entire, not emarginate medianly; front closely punctured between the eyes, with a strong median biramose process above the antennae; larger forms, 6-8 mm. long.......................................*rutilans* (Blake)
   Lower margin of lamella on inferior edge of mandible emarginate medianly; smaller forms, 3-6 mm. long.................................. 4
4. Front less closely punctured between the eyes and with a moderate process above the base of each antenna..................*parvula* Fox
   Front more closely punctured between the antennae and with a weak median biramose process above the antennae...*exaggerata* new species

Myrmosa (Myrmosula) parvula Fox (Pl. XXIV, figs. 5, 10.)

Myrmosa parvula Fox, Journ. N. Y. Ent. Soc., p. 53, (1893); [♂].—Fox, Trans. Amer. Ent. Soc., xxv, p. 286, (1899); [♂].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 12, (1903).

Mutilla antisemitica Dalla Torre, Cat. Hym., viii, p. 10, (1897); [*nom. nov.* for *parvula* Fox, *nec Mutilla parvula* Fabricius]

Brachycistis bimaculatus Fox, Trans. Amer. Ent. Soc., xxv, p. 285, (1899); [♀].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 9, (1903). (New Synonymy.)

Myrmosa (*Myrmosula*) *parvula* Bradley, Trans. Amer. Ent. Soc., xliii, p. 252, pl. 20, fig. 1, (1917); [♂].

Brachycistis bimaculata Bradley, Trans. Amer. Ent. Soc, xliii, p. 281, (1917); [♀].

Myrmosula parvula Bridwell, Proc. Hawaiian Ent. Soc, iv, p. 392, (1920).

This species is most closely related to *rufiventris* Blake and *exaggerata* new species. From the former, known only from the male sex, it is separated by the lack of a beak-like process on the medio-apical area of the clypeus, the black abdomen and the third submarginal cell of the fore wing which is higher than long and narrowed above; from the latter species, known only from the female, it is separated by the character of the antennal processes which are separated and do not form a biramose process and by the sparser puncturation between the eyes.

Type.—♂; [Southern] Ill[inois]. [Academy of Natural Sciences of Philadelphia, Type no. 4675].

Male. 3 to 6 mm. long. Black; mandibles apically, tegulae and occasionally the tip of the abdomen, ferruginous; at times other portions of the body; particularly the legs and abdomen, may be piceous; one specimen from Clifton, Va. is castaneous, the abdomen and legs being somewhat lighter than the head and thorax but the other structural characters place it in *parvula* and I believe the color change may be due to the preservative in which the insect had been placed after its capture or possibly the specimen may be a teneral. Sparsely clothed with short erect cinereous to dark brown pubescence. Wings hyaline; costa, subcosta and stigma piceous, the remaining veins testaceous.

Head fulgid, finely punctured, the clypeus more closely so than the rest of the head; clypeus tumid medio-apically.

Thorax fulgid, finely punctured, the propodeum and mesopleura much more closely punctured than the other portions; tegulae with sparse fine punctures; second submarginal cell of fore wing pentagonal, the third submarginal narrowed above and higher than long.

Abdomen fulgid, finely punctured, the tergum more sparsely so than the sternum.

Female.—3 to 6 mm. long. Light to dark ferruginous; tip of mandibles, apical one or two segments of antenna, narrow apical margin of first abdominal tergite, a pair of transverse spots on postero-lateral corners of second tergite, a broad apical band on the third tergite, a pair of lateral spots on fourth tergite and the last tergite and sternite, darker than the lighter ferruginous areas, varying from brunneous to piceous; a pair of spots toward the antero-lateral corners of the second tergite and a median spot, occasionally lacking, on the fifth tergite and occasionally the sixth tergite basally, white. Appressed silvery pubescence of head and thorax much as in *exaggerata* but not so dense; as in other members of the subgenus, the abundant erect hairs of the abdomen are in general white when arising from the lighter areas and cinerous to dark brown when arising from the darker areas with the exception of the last segment where the pubescence may be white.

Head fulgid, finely and moderately closely punctured, though not so closely as in *exaggerata;* clypeus short, the apical margin thickened and emarginate medianly; mandible basally with a lamella on the inferior edge which is more deeply emarginate than in *exaggerata;* frontal processes overhanging the bases of the antennae well-separated, tuberculiform and not forming a median biramose process; vertex more closely punctured than the front.

Thorax fulgid, finely and rather closely punctured, the pleura less closely than the dorsum.

Abdomen fulgid, finely and moderately punctured, not so closely as the head and thoracic dorsum.

The almost identical ranges of the males and females leave little doubt but that they represent the two sexes of one species. Furthermore, Mr. Bridwell has taken both sexes together (not in copula) rather commonly in the vicinity of Washington, D. C. and informs me that unquestionably they belong to the same species. Therefore, I have synonymized *bimaculata* (Fox) with *parvula* Fox.

Distribution.—Apparently confined to the Upper and Lower Austral subregions, occasionally penetrating into the Sonoran.

Specimens examined: 63; 50 females, 13 males.

DISTRICT OF COLUMBIA: 1♀, Q St. Bridge, Rock Creek Park, Washington, July 26, 1920, (J. C. Bridwell), [Brid].

VIRGINIA: 1♀, Falls Church, Sept. 18, (N. Banks), [CU]. 1♂, Beverly Hills, July 5, 1931, (J. C. Bridwell); 1♂, 12♀, Clifton, June 11 - Aug. 27, (J. C. Bridwell); [both Brid]. 4♂, 24♀, Barcroft, July-Sept. 13, (J. C. Bridwell, P. H. Timberlake; one ♀ struggling on ground with *Chloralictus zephyrus* Smith near entrance to nest), [Brid, USNM, PHT].

GEORGIA: 1♂, Atlanta, Aug. 2, 1913, (J. C. Bradley), [CU].

ALABAMA: 1♂, 2♀, Auburn, Lee Co., June 9, 1917, [Beq, UM].

OHIO: 3♀, West Jefferson, Franklin Co., [Beq].

ILLINOIS: 1♂, So. Illinois, (type of *parvula*), [ANSP]. 1♀, Crystal Lake Park, Urbana, Aug. 15, 1915, [UM]. 1♂, Urbana, July 28, 1891, (Hart & Shiga; from flowers of wild parsnip); 1♂, Waterman, Aug. 1882; [both INHS].

MICHIGAN: 1♀, Ann Arbor, July 16, 1923, (E. G. Anderson), [UM].

MISSOURI: 1♀, Ripley Co., (type of *bimaculatus*), [ANSP]. 1♀, Kirkwood, June 1930, (Phil Rau), [USNM]. 2♀, Webster Groves, June 1928, (F. X. Williams), [FXW].

TEXAS: 1♂, Round River, Williamson Co., Oct. 10, 1935, (J. E. Gillaspy), [JEG]. 1♀, New Braunfels, May 23-26, 1918, (J. C. Bradley), [CU].

MONTANA: 1♂, no other data, [ANSP].

Ethology.—Mr. Bridwell has taken a female of this species struggling on the ground with a female *Halictus* (*Chloralictus*) *zephyrus* Smith at the entrance to the burrow and Mr. Timberlake's female bears a label stating that it was taken near *Chloralictus* nests.

Myrmosa (Myrmosula) rufiventris Blake

Myrmosa rufiventris Blake, Trans. Amer. Ent. Soc., VII, p. 254, (1879); [♂].—Blake, Trans. Amer. Ent. Soc., XIII, p. 278, (1886); [♂].—Cresson, Trans. Amer. Ent. Soc., Suppl., XIV, p. 267, (1887).—Fox. Journ. N. Y. Ent.

Soc., p. 53, (1893); [♂].—Fox, Trans. Amer. Ent. Soc., xxv, p. 286, (1899); [♂].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 13, (1903).

Mutilla erythrogastra Dalla Torre, Cat. Hym., VIII, p. 36, (1897); [*nom. nov.* for *rufiventris* Blake *nec Mutilla rufiventris* Smith].

Myrmosa (*Myrmosula*) *rufiventris* Bradley, Trans. Amer. Ent. Soc., XLIII, p. 252, (1917); [♂].

Myrmosula rufiventris Bridwell, Proc. Hawaiian Ent. Soc., IV, pp. 392-3, (1920); [♂].

The quadrate third submarginal cell of the fore wing, the small beak-like process on the medio-apical area of the clypeus and the ferruginous abdomen distinguish this species from its close relative *parvula* Fox. The female is as yet unknown but may prove eventually to be *exaggerata* new species.

Type.—♂; Nev[ada]. [Academy of Natural Sciences of Philadelphia, Type no. 4600].

Male. 5.5 mm. long. Black; abdomen except first segment, ferruginous. Clothed with sparse short erect black hairs. Wings hyaline; venation testaceous to black.

Head fulgid, finely and rather closely punctured; clypeus with a small beak-like projection medio-apically.

Thorax fulgid, finely and closely punctured; tegulae with sparse fine punctures; third submarginal cell of fore wing quadrate, longer than high.

Abdomen fulgid, finely and moderately closely punctate.

Distribution.—On the basis of the material collected to date, *rufiventris* is apparently confined to Nevada and Oregon (Bridwell, 1920). Future collecting may prove it to have a more extended range into California and Arizona.

Specimens examined: 1♂, Nev[ada], (the type), [ANSP].

Myrmosa (Myrmosula) exaggerata new species

This species, known only from the unique female type, is very closely allied to *parvula* Fox, differing chiefly in the closer puncturation of the front and the weak biramose process above the antennae. It is quite possible that it may prove to be the still unknown female of *rufiventris* Blake, but until further material is at hand indicating that the two species do occur in the same localities, I prefer to treat them as separate species.

Type.—♀; Citrus Exp[eriment] Station, Riverside, Cal[ifornia]. Oct. 7, 1924. (H. S. Smith). [Citrus Experiment Station].

Female. 3.5 mm. long. Light ferruginous; tip of mandible, narrow apical margin of first abdominal tergite and a pair of large spots near the postero-lateral corners of the second tergite, castaneous; a pair of spots situated toward the antero-lateral corners of the second tergite and a median spot on the fifth tergite, white. Head and thorax covered with abundant short appressed glittering pubescence and scattered erect white hairs; ferruginous and white areas of first and second tergites and all sternites with numerous short erect white hairs, the darker areas and tergites three to six with numerous short erect dark brown to black hairs.

Head subfulgid, closely and finely punctured; mandible basally with a lamelliform process on the inferior edge which is slightly emarginate medianly; clypeus short, its apical margin thickened and emarginate; frontal processes joined basally to form a weak median biramose process overhanging the bases of the antennae.

Thorax subfulgid, closely and finely punctured.

Abdomen fulgid, finely but not so closely punctured as the head and thorax.

Male. Unknown.

Myrmosa (Myrmosula) rutilans (Blake) new combination
(Pl. XXIV, fig. 12.)

Mutilla rutilans Blake, Trans. Amer. Ent. Soc., VII, p. 248, (1879); [♀].—Blake, Trans. Amer. Ent. Soc., XIII, p. 204, (1886); [♀].—Cresson, Trans. Amer. Ent. Soc., Suppl., XIV, p. 264, (1887).—Dalla Torre, Cat. Hym., VIII, p. 83, (1897).

Brachycistis rutilans Fox, Trans. Amer. Ent. Soc., XXV, p. 285, (1899); [♀].—André, Genera Insect., Fam. Mutillidae, Fasc. 11, p. 10, (1903).—Bradley, Trans. Amer. Ent. Soc., XLIII, pp. 280-1, (1917); [♀].

The larger size and the character of the lamelliform process of the mandible which is not emarginate medianly, separate this species, known only from the female, from its congeners, *parvula* Fox and *exaggerata* new species.

Type.—♀; Cal[ifornia]. [Academy of Natural Sciences of Philadelphia, Type no. 4598].

Female. 6 to 8 mm. long. Brunneous; tip of mandibles, narrow apical margin of first abdominal tergite, a pair of spots on postero-lateral corners of second tergite, a broader apical band on the third and fourth tergites and apices of sixth tergite and sternite (apical margins of second to fifth sternites also in one specimen), varying from castaneous to black; a pair of median spots toward the antero-lateral corners of the second tergite and a median spot on the fifth tergite (base of sixth tergite also in one specimen), varying from white to eburneous. Head and thorax clothed with abundant short appressed glittering white pubescence and scattered erect white hairs; lighter colored areas of abdomen and all tergites laterally with numerous short erect glittering white hairs, the darker areas with numerous erect short brown to black hairs.

Head subfulgid, closely and finely punctured; mandible basally with a lamella on the inferior edge which is not emarginate medianly; clypeus short, the apical margin thickened medianly and slightly emarginate; frontal processes confluent basally forming a strong biramose process overhanging the bases of the antennae; antennae long and filiform.

Thorax subfulgid, closely and finely punctured.

Abdomen subfulgid, closely and more finely punctured than the head and thorax.

Male. Unknown.

Specimens examined: 5 females.

CALIFORNIA: 1♀, no other data, [ANSP; the type]. 1♀, La Jolla, San Diego Co., July, (G. P. Engelhardt), [USNM]. 1♀, Alameda Co., Sept. 4, 1919, (F. W. Nunenmacher), [FWN]. 1♀, Felton, Santa Cruz Mts., 300-500 ft. elev., May 20-25, 1907, (J. C. Bradley), [CU]. 1♀, near Victorville, Mojave River, May 28, 1932, (P. H. Timberlake), [PHT].

SPECIES INCERTAE SEDIS

It has been impossible to place the following species definitely owing to the inadequacy of the original descriptions.

Myrmosa (Myrmosa) czerskii Skorikov

Myrmosa czerskii Skorikov, Annu. Mus. Zool. Acad. Sci., Leningrad, xxx, p. 246, (1929); [♀].

Skorikov indicates that *czerskii,* known from the female sex only, is very closely related to *brunnipes* Lepeletier. The fact that I have before me a male from Manchoukuo (just west of the type locality of *czerskii*) which is definitely *brunnipes* makes me wonder whether Skorikov's species is merely a local variant of *brunnipes* or, in fact, identical with it. However, pending an examination of the type I am placing Skorikov's species in this group of species of uncertain position rather than in the synonymy of *brunnipes.*

I am greatly indebted to Mr. John N. Belkin of Cornell University for the translation of the following description from the original Russian. The description is in the form of a descriptive key and I have included here the portions of the couplets relative to this form.

" Hind part of metathorax more or less triangularly, strongly narrowed ventrally.

"Sternite one with a hook of considerable size.

"Head widened towards the region of the eyes. Thorax posteriorly, on the sides near the base, with a keel-like elevation. Abdomen proximally with two swellings (convexities). Distance between the antennal tubercles greater than in *M. brunnipes*. Width of thorax 50% of its length (as contrasted with 45% in *brunnipes*). Prothorax anteriorly with a slight arched (bow shaped) convexity (greater than in *M. brunnipes*) humeri with a tooth-like growth (projection), lateral margins parallel, slightly sinuate. Lateral margins of the mesothorax after a slight anterior widening are strongly constricted towards the back, forming in front of the protuberance another widening which is continued on the metathorax; posteriorly the thorax is convexly swollen. Head entirely black, except for a brown anterior portion (near mandibles) and antennae; prothorax rufous, mesothorax dark brown; metathorax brown. First abdominal segment dark at base, gradually becoming rufous posteriorly; furnished with a thick golden fringe near its hind margin. The remainder of the body is black, shining. Southern Oussourii [Ussurii] district."

Male. Unknown.

Myrmosa (Myrmosa) macrocephala Olivier

Myrmosa macrocephala Olivier, Encycl. meth. Ins., VIII, p. 130, (1811); [♂].

Mutilla macrocephala Dalla Torre, Cat. Hym., VIII, p. 56, (1897).

The species cannot be placed because of the meagre description. The locality, as given by Oliver, is probably wrong, or else the species has been placed in the wrong genus.

Type.—♂; Java. (Bosc). [Collection unknown].

Male. "It is a little larger than the preceding [*thoracica* Fabr.]. The antennae are filiform, scarcely longer than the thorax. Head black, punctate, plainly covered with greyish hairs, a little wider than the thorax. The latter is black, punctate, somewhat hairy. The abdomen is black, ovate-elongate, slightly depressed. The first segment is narrow basally, slightly elongate, very distinct. Legs black. Wings transparent."

Female. Unknown.

Myrmosa (Myrmosa) myrmillicephala Skorikov

Myrmosa myrmillicephala Skorikov, Trud. Tadzhik. Sect. Acad. S. S. R. (Zool. & Parasit.), v, p. 286, (1935).

I have been unable to consult this periodical nor to get in communication with Mr. Skorikov. The Zoological Record (1936) states that the species was described from Bukhara [Turkestan, U.S.S.R.].

Myrmosa (Myrmosa) pulla Nylander

Myrmosa pulla Nylander, Notis. Saellsk. faun. & flor. Fenn. Förh., I, p. 18, (1848); [♂].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 124-5, 443, (1900-3); [♂].

Mutilla pulla Dalla Torre, Cat. Hym., VIII, p. 75, (1897).

This species probably does not belong in the subfamily Myrmosinae if Nylander is correct in his statement that the hind coxa does not have a lamelliform process. Dr. Wolter Hellén of the Zoological Museum of the University of Helsinki, Finland, informs me that the type is not in that institution which received the bulk of the Nylander collection and Dr. Walter M. Linnaniemi of the Zoological Institute at the University of Åbo, Finland which received most of the Sahlberg collection informs me that the type cannot be found in that institution, so it is quite likely that the specimen is no longer in existence.

Type.— ♂ ; Siberia, U. S. S. R. (Sahlberg). [Collection unknown].

Male. "4 mm. long. Black; moderately clothed with cinereous pubescence; wings entirely hyaline, nervures and stigma fusco-brunneous.

Posterior coxae without a dentiform appendage; last tergite entire at apex, slightly obtuse."

Female. Unknown.

Myrmosa (Myrmosa) Radoszkowskii Saussure

Myrmosa Radoszkowskii Saussure (in Fedtschenko), Voyage au Turkestan, Hym., p. 12, (1880); [♂].—André, Spec. Hym. d'Eur. et d'Alg., VIII, pp. 123-4, 442, (1900-3); [♂].

Mutilla Radoszkowskii Dalla Torre, Cat. Hym., VIII, p. 77, (1897).

This species will probably turn out to be a synonym of *melanocephala* (Fabricius).

Type.— ♂ ; Turkestan, U. S. S. R. [Zoological Museum of Leningrad -?].

Male. "5.5 mm. long. Black; clothed with cinereous pubescence; wings hyaline.

Clypeus armed as in *unicolor*."

Female. Unknown.

EXPLANATION OF FIGURES

The figures of the male genitalia were projected and drawn by the author from balsam slide mounts. Each of these figures shows half the dorsal aspect at the left, half the ventral aspect in the center and the hypopygium (eighth ventral segment) at the right. The figures of the mandibles of females of *Myrmosa* (*Myrmosula*) were drawn with the aid of a *camera lucida*. Figures 1 to 9 and 11 are enlarged 29 times; figures 10 and 12 are enlarged 19 times.

PLATE XXIII

Fig. 1.—Male genitalia of *Myrmosa* (*Myrmosa*) *nigriceps* S. S. Saunders.

Fig. 2.—Male genitalia of *Myrmosa* (*Myrmosa*) *bradleyi* Roberts.

Fig. 3.—Male genitalia of *Myrmosa* (*Myrmosa*) *tangerina* Mercet.

Fig. 4.—Male genitalia of *Myrmosa* (*Myrmosa*) *frater* (Ed. Saunders) paratype.

Fig. 5.—Male genitalia of *Myrmosa* (*Myrmosula*) *parvula* Fox.

Fig. 6.—Male genitalia of *Myrmosa* (*Myrmosa*) *unicolor* Say.

Fig. 7.—Male genitalia of *Myrmosa* (*Myrmosa*) *thoracica* (Fabricius).

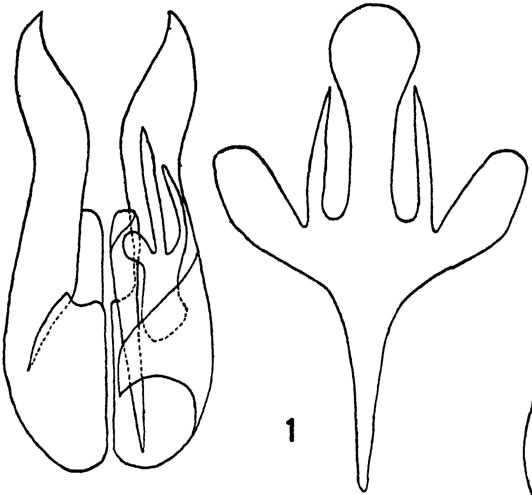
Fig. 8.—Male genitalia of *Myrmosa* (*Myrmosa*) *melanocephala melanocephala* (Fabricius).

Fig. 9.—Male genitalia of *Myrmosa* (*Myrmosina*) *nocturna nocturna* new species paratype.

Fig. 10.—Female mandible of *Myrmosa* (*Myrmosula*) *parvula* Fox.

Fig. 11.—Male genitalia of *Myrmosa* (*Myrmosa*) *brunnipes* Lepeletier.

Fig. 12.—Female mandible of *Myrmosa* (*Myrmosula*) *rutilans* (Blake).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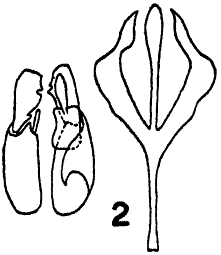
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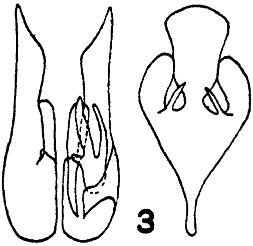
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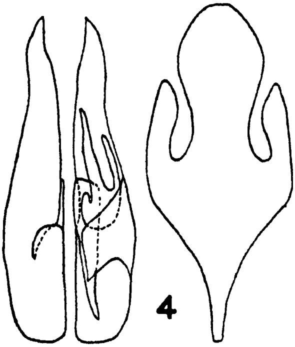
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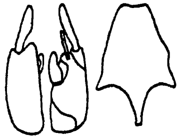
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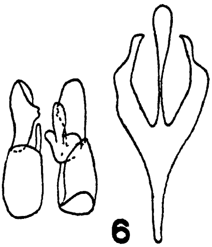
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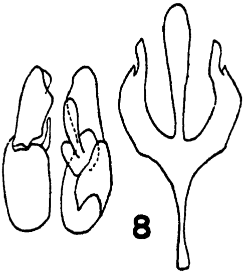
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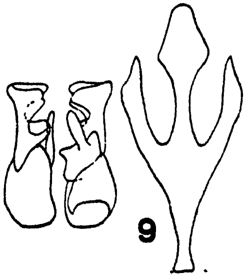
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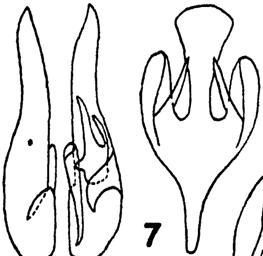
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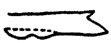
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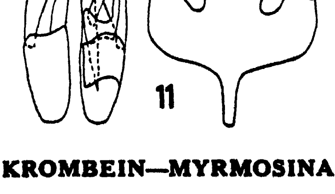
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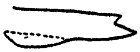
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KROMBEIN—MYRMOSINAE

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